THE AEROPLANE

Incorporating
Aeronautical Engineering
Edited by - - THURSTAN JAMES

Founder and First Editor
(1911-1939), C. G. GREY

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MONSTROUS! THAT BIRD AGAIN

ONE question that plenty of people would like satisfactorily answered concerns the R.34 memorial, but it can only be answered by the Air League, and the Council of that august body does not meet until December 9. When it does meet we can all be sure that the agenda will contain reference to a remarkable debate in the House of Lords on November 20. We can also be sure that before December 9 the Minister of Transport and Civil Aviation will also have discussed the situation. We expect that Lord Bridges, chairman of the Royal Fine Art Commission, will have been brought into the discussions as well. So even if we do have to wait for a couple of weeks before the next visible move, British aeronautical circles once again have to thank Lord Brabazon for taking up the cudgels to right a wrong.

By now there can be few people who do not know about the two-headed monster of portentous aspect which the Council of the Air League intend to erect, not as a warning, mark you, but as a memorial to the first men, and there were 33 of them, to make the first air crossing of the Atlantic from the Old World to the New. They did it by airship in 1919 and it was another 19 years before the aeroplane could transport a tenth of their number against the same inclement atmosphere. This airship and its crew were British. So were the engines.

Consequently, the Air League had the widest possible support for their decision to commemorate the venture. However, good intentions, as we all know, are not enough. In fact, an ancient adage says the road to hell is paved with them. This particular intention may not yet have got anyone involved with the underworld, but the sculptor commissioned, at the second attempt, by the Air League has certainly produced a representation of what may well be construed as a denizen of the nether regions. It has nothing of the buoyant grace or streamline shape of the dirigible lighter-than-air craft or airship.

We note that broadly speaking the question of "fine art" was not one which received major attention by their Lordships when discussing the matter in the House on November 20 after a motion had been put forward by Lord Brabazon asking among other questions whether Her Majesty's Government considered that a bronze memorial (from the design already exhibited) 14 ft. high would be a suitable object for exhibition at the principal gateway of Great Britain. In the course of the hour-long debate which followed, the Viscount Templewood, Lord Winster, Lord Teviot, Lord Mottistone, Lord Waleran, and Earl Swinton supported Lord Brabazon. Lord Strobolgi thought it would be better to let well alone and that future generations would be grateful to have the memorial.

One of the strongest cards played by Lord Brabazon was to quote from a letter written to him by Sir Frederick Tymms, Master of the Guild of Air Pilots and Air Navigators who, speaking for the Guild, said "We feel intensely that this monstrous proposal is an outrage" to the memory of those who built and flew the R.34 both ways across the Atlantic.

Lord Winster, himself a former Minister of Civil Aviation and now president of the Merchant Navy and Air Line Officers Association, referred to the extreme indignation which many members of that Association feel over the matter. We cannot, alas, quote the debate *in extenso*, but we can recommend our readers to Hansard. We feel that the observations of Lord Mottistone, himself a distinguished architect, should not go unrecorded here. He was not to be persuaded that the sinister and depressing model which was being discussed could ever bring out the success of the airship R.34's achievement.

We are sorry for the Minister of Transport and Civil Aviation. The Air League has gone to him for permission to erect a memorial to a notable British achievement. The suitability of their commissioned design, in so far as standards of "fine art" are concerned, has been duly endorsed by the Royal Fine Art Commission. Unfortunately, plenty of people in aviation, not least among them airship enthusiasts and survivors, have expressed their disapproval of the design as a means of acquainting generations yet unborn of what was achieved by thirty-three pioneers in the year 1919 with the aid of a rigid airship.

All of us must hope that in the face of so much aeronautical opposition the Minister will suggest to the Air League that they might care to think again. And if the Air League persists in regarding its function as patron of the arts more highly than of its function to maintain adequate air forces and the fullest development of British commercial and public flying then let them present this newest sample of modern art, as Lord Brabazon suggested, to the Tate Gallery. There it will be viewed by people who understand such things and it will not frown terrifyingly upon the hurrying throngs at London Airport whose origins trace back to when the R.34 pioneered the transatlantic route.

MATTERS OF MOMENT

Missile Squadrons in the R.A.F.

DURING a recent visit to the R.A.F.'s first SAGW station, at North Coates in Lincolnshire (see THE AEROPLANE for November 7) where the Bristol-Ferranti Bloodhound surface-to-air guided weapons system is undergoing acceptance and Service trials, it was explained that the missiles were to be operated in "fire units." Each of these was made up of two sections of —at present—eight launchers and the requisite number of Bloodhounds.

These fire units have now been given the official name of Air Defence Missile Squadrons and the first of these is at present being formed at North Coates. It will, in fact, be formally brought into being on December 1 as No. 264 Air Defence Missile Squadron—the numbers for these new formations being those of former fighter squadrons now disbanded. (Likewise the ballistic missile operational formations will be given former bomber squadron numbers and will be known as Strategic Missile Squadrons.)

During our visit to North Coates earlier this month, there were indications that a Bloodhound "Wing" would be located there and composed of three of these new squadrons having, altogether, 48 launchers. This numerical make-up, it was explained, might, however, be modified later in the light of experience during the trials period. Each squadron will have a launch control post and two target-illuminating radar sets—one for each section, or flight, of eight weapons.

Although "operational" No. 264 Squadron will not be able to operate fully from its proper base; for obvious reasons its activities at North Coates will have to be restricted to operation of the weapons system no further than the point of pressing an unarmed firing button. In peace-time the weapons can be launched only from the firing range at Aberporth.

But the Bloodhounds, after all, are only the shells that come out of a fully automatic "gun" and theoretically it is not necessary for them actually to be fired in order to ensure that the system's operators are fully practised in the art of interception by guided missiles. For all that, however, the situation *is* rather like a fighter squadron that is equipped with aeroplanes that it must not fly.

Summing up the Situation

A FORTHRIGHT comment on current aviation affairs in this country, which has received a great deal of attention, was made last week by Mr. Geoffrey Hall, F.R.Ae.S., M.S.A.E., chairman and managing director of the Fairey Aviation Co., Ltd. He was reporting to the shareholders at the annual general meeting on November 20. He expressed the view that despite the gloomy outlook for the aircraft industry the work being done by the company's subsidiaries was excellent and expanding; their efforts at diversification were showing encouraging signs. Mr. Hall warned the meeting, however, that it might be necessary to close down certain of Fairey's aircraft facilities "with consequent major redundancy of labour."

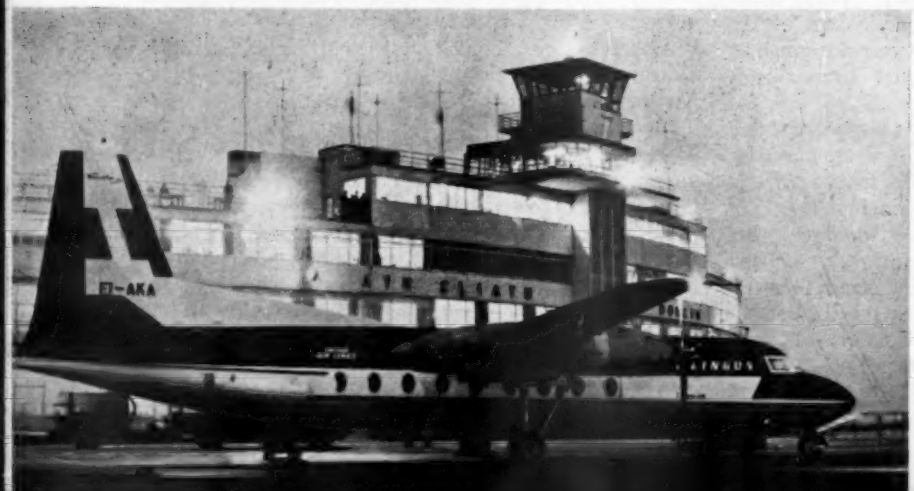
After recording a consolidated group trading profit—before taxation—of £2,231,146, which, he said, showed little variation compared with the figures for the three preceding years, he went on to refer to the need to spend more in order to obtain production work. "It is no secret," said Mr. Hall, "that the aircraft industry is facing a very difficult situation, possibly the most difficult in its entire history, and our company is no exception to the general rule. The present defence policy has caused a lack of orders for military aircraft and it has thus become essential, almost overnight, to find extensive work in the civil aircraft market if our engineering and production potential is to be utilized.

"This, in itself, would be sufficiently difficult, but in parallel with the sudden lack of orders—and research support—the Government has indicated that on civil aircraft research, development and production the industry must largely stand on its own feet. In consequence we are faced with spending larger sums than ever before in order to obtain production work in this field."

Later, he commented that the activities of the aircraft industry had turned a complete somersault. "Whereas a few years ago," he said, "our factories were working at high pressure and we were being pressed by the Government to meet the then urgent requirements, we now face a complete reversal where, as a result of the White Paper on Defence and Government policies, we have the resources on our hands but insufficient aircraft work to utilize all our facilities.

"This abrupt change, with the added factor that the aircraft industry in the civil field has to be self-supporting and has to compete with foreign aircraft industries which are subsidized by their Governments, and have large home markets, has created

PRESENTATION.—Air Chief Marshal Sir Theodore McEvoy, Chief of Staff at Headquarters Allied Air Forces Central Europe (right) receives a golfing trophy from Gp. Capt. Douglas Bader at a dinner of the Fontainebleau Military Golf Society on November 21. Sir Theodore, who is the Society's president, won the trophy in a recent tournament.



FRIENDSHIP IN DUBLIN.—Aer Lingus took delivery of their first two Fokker Friendships on November 19. They were named "Fergal" and "Fintan" at Schiphol by Mrs. Gallagher, wife of the Irish Minister to the Netherlands, and then flown to Dublin. They are expected in service to Paris on December 15 and to provincial cities in the U.K. before the end of the year.

THE NAVY'S NEXT.—Now in the initial production stages the Blackburn NA.39 is on order for the Royal Navy as a specialized carrier-borne low-level strike aircraft powered by two Gyron Junior turbojets. A special supplement in this issue (pages 787 to 803) describes the current organization and equipment of the Fleet Air Arm.

a situation which is not only one full of imponderables, but also one full of difficulties to resolve, owing to the lack of clarity with regard to the ultimate intentions of the Government concerning the industry.

"As an industry, if we are to continue we must maintain the expensive research and development facilities necessary for aircraft design and production, for without this we cannot hope to compete with aircraft companies overseas. A Government policy which refuses to accept the need to support such facilities must, of necessity, also accept that this will inevitably mean the withering away of this country's entire future in the air.

"Mere grouping will not affect this situation, for if the entire research and development costs of new and novel ideas are to be borne by sales of aircraft to civil operators, then such aircraft cannot be sold at prices which can compete with aircraft of other countries whose development costs have been borne by military or similar Government orders. Capital and man-power resources by themselves are of no value if the developed aircraft cannot be sold. We can only hope that reason will prevail and support be given to the research and development projects necessary to keep this country in the forefront of aviation."

Referring to the Fairey Rotodyne, Mr. Hall said that since the end of 1957 the company had been financing the project while negotiations proceeded with the Government to try to find a financial solution. To date they had not had a final reply but they could not after this long delay be entirely hopeful as to the eventual outcome. They were determined, however, to proceed with the Rotodyne and put it into production; the financing of this operation would be difficult and could well involve support from, and manufacture, outside this country.

It was no surprise that considerable interest had been shown in the aircraft by the airline operators of the World and by the U.S.A.F. Mr. Hall referred to Fairey's agreement with Kaman Aircraft Corporation whereby that company could sell and build the Rotodyne in the U.S. He believed the Rotodyne to be one of the most important aircraft developments in the World.

Percival Continued

FOR some time the future of Edgar Percival Aircraft, Ltd., and of its product, the EP.9 general-purpose aircraft, have been uncertain; it has now been announced that Samlesbury Engineering, Ltd., has purchased the company, which will in future be known as the Lancashire Aircraft Corporation, Ltd. Production of the EP.9 will continue at Stapleford Tawney, but will eventually be transferred to better premises at Samlesbury, near Blackburn, and at Squire's Gate, Blackpool.

Samlesbury Engineering, Ltd., is one of the group of companies of Eric Rylands, Ltd., and Mr. Rylands is the chairman of the new company; also on the board are Capt. E. W. Percival (non-executive) and Sir Wavell Wakefield, M.P.

The company formerly known as the Lancashire Aircraft Corporation, Ltd., was once a subsidiary of Eric Rylands, Ltd., and was transferred some time ago to British Aviation Services; this latter company has agreed to cede the title to Mr. Rylands.

With this step the activities of Samlesbury Engineering will include, apart from complete manufacture of the EP.9, production of major components for Comet, Viscount, Vanguard and Scimitar aircraft, and for certain other types; aircraft overhaul; machined components and sheet metalwork, and design and manufacture of aircraft equipment, along with other work not specifically for the aviation industry.

Standardizing Civil Radio

AN inaugural meeting of the Air Transport Electronics Council was held in London on November 18, when Sir Victor Tait, K.B.E., C.B., B.Sc., was appointed chairman. The council has as its principal aim the standardization of civil aircraft radio equipment and systems, and the development of systems for future air operating requirements. As constituted at present, it is made up of representatives of the Electronic Engineering Association (representing the British radio and electronics manufacturers), the S.B.A.C., B.O.A.C., B.E.A., and B.I.A.T.A.

Secretariat for the council is being provided by International Aeradio, Ltd., and Mr. J. S. Simpson has been appointed secretary. He has recently visited the U.S.A. to make contact with Aeronautical Radio Incorporated there, and has arranged for mutual co-operation between the two organizations.

Offices of the Air Transport Electronics Council have been established at 37 Park Street, London, W.1. The telephone number is Hyde Park 5024.

Developments in Canada

A CANADIAN Airworthiness Council has been set up by the Minister of Transport, The Hon. George Hees, to advise him on questions concerning aeronautical engineering, airworthiness, inspection, the maintenance and certification of aircraft—and on such other related matters as he might wish to refer to it. In making this announcement he described it as a major step forward in the establishment of closer liaison between his department and all phases of the civil aviation industry in Canada. He was speaking at the annual dinner of the Air Industries and Transport Association of Canada in Quebec on November 6.

The new Council will be under the chairmanship of the chief aeronautical engineer of the Department of Transport—at present Mr. H. S. Rees. There will be six other members of the Council which will comprise two representatives of the builders and repairers of aircraft and aero-engines, and two representatives of the commercial operators. Another member will represent the commercial pilots; and the sixth, the aviation insurance underwriters. These members will be appointed for a period of two years.

This is an important development in Canadian civil aviation administration which brings it more nearly into line with that in operation elsewhere. It will no doubt go a long way towards ensuring, as the Minister said, that the highly complicated and rapidly changing technical matters in the field of airworthiness are adequately and properly dealt with.

The Aeroplane—An Epitome

GIVING the first of three Cantor lectures on "The Aeroplane" before the Royal Society of Arts last Monday, Mr. C. H. Gibbs-Smith, M.A., concerned himself largely with the historical contribution of the Wright brothers. A small but distinguished audience heard Mr. Gibbs-Smith describe the achievement and failures of some pre-Wright experimenters. He went on to explain how the Wrights' work on controls and engines led to their brilliant success, and why this success was for so long unappreciated. The address was excellently illustrated.

Next Monday, December 1, the series is continued by Mr. Peter Brooks, who will deal with the development of the aeroplane up to date. On December 8 Mr. Eric Mensforth will take as his subject "The Future of the Aeroplane." Mr. Roland E. Dangerfield, chairman and managing director of Temple Press Limited, is in the chair for all three meetings. The three papers will be printed together and sold by the R.S.A. price 5s.

F.A.A. Fighters Grounded

ABOUT 20-30 jet aircraft of the Royal Navy were affected last week by the precautionary grounding of F.A.A. types fitted with the Martin-Baker Mk. 4 ejection-seat. This move by the Admiralty followed an accident on November 19 in which a young Naval pilot died after ejecting at low level and high speed from a Scimitar of No. 807 Squadron at Lossiemouth.

As deployment of his parachute was not complete before ground impact, the ejection-seat operation was treated as suspect pending inquiry, affecting the two Scimitar squadrons and the handful of Sea Vixens and Hunter T.8s. R.A.F. aircraft with the Mk. 4 seat, including later marks of Javelins and Hunter T.7s, had not been affected when we closed for press.

Restrictions were also imposed by the Admiralty on the operation of Whirlwind 7 helicopters over the sea, following the failure of certain engine components. It is hoped that by temporarily limiting the aircraft to land operation, diagnosis of a possibly recurrent fault will be simplified.

Manned Satellites by A.W.A.

FOR 18 months an Armstrong Whitworth design team under Dr. W. F. Hilton, the company's chief aerodynamicist, has been making design studies of manned satellites. Launching, orbital and re-entry techniques have been studied. This news was given by Dr. Hilton on November 19 in a lecture to the Coventry branch of the Royal Aeronautical Society.

For the launching, ramjets have been considered in place of rockets for some stages. This is because the kerosene fuel of ramjets gives a better specific impulse than some of the more exotic rocket fuels and is considerably less dangerous to handle.

The re-entry vehicle now being designed is a tail-stabilized glider. Much early study was devoted to the use of spin stabilization during re-entry instead of depending on tail surfaces, but the difficulties, particularly with the pilot's controls, have led to the current design with tail stabilization. In consequence the circular planform considered in earlier Armstrong Whitworth studies is no longer to be used.

For gradual re-entry a series of techniques are necessary. These are the forming of shock waves to heat the air at a distance instead of the vehicle itself; prolonging the descent time to allow thermal radiation from the vehicle to cool it down; low wing loading so that the vehicle can fly higher where heat input will be reduced because of lower air density; and use of the vehicle as a heat sink.

High lift is needed, combined with strong shocks to heat air at a distance and thus a high pressure drag is necessary. Wing loadings of 15 lb./sq. ft. seem practical and would result in a theoretical maximum heating rate of 119 kW./sq. ft., which would occur at 3 miles/sec. Shock heating of remote air might reduce this to 10 or 20 kW./sq. ft.; this is only the intensity of an electric-fire element and manageable by ordinary engineering methods.

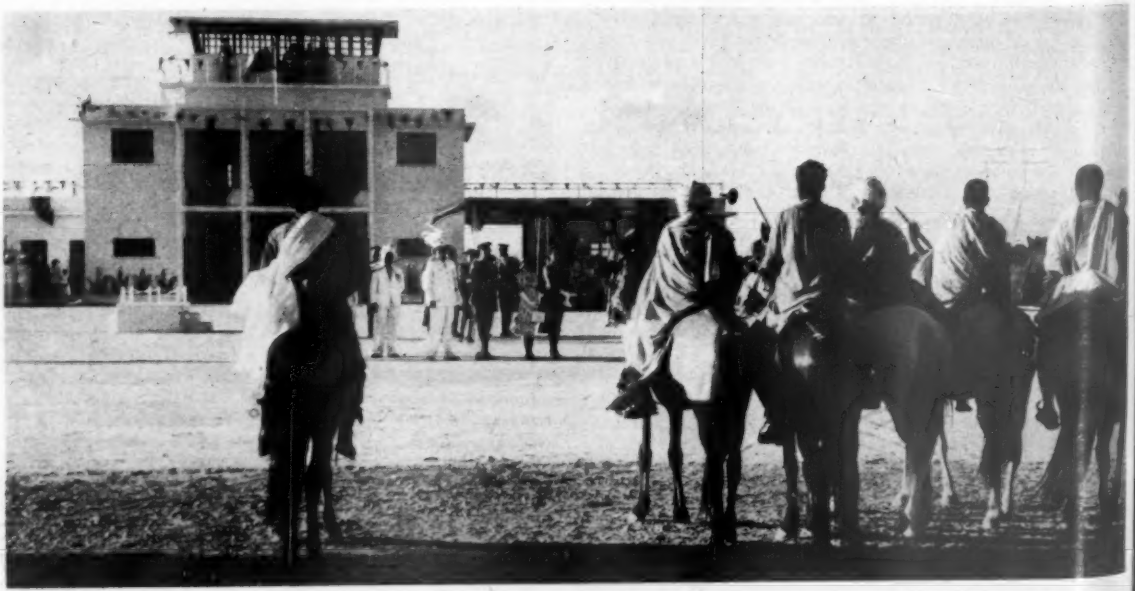
Royal Occasion in Somaliland

RAPID increase in the growth of air travel brings as many problems to the smaller remote airports as to the larger international ones. Hargeisa—about 100 miles south-east of Berbera—in the Somaliland Protectorate has been faced with these problems and has now solved them in a way which would be a credit to many large airports.

A new terminal building was opened at Hargeisa Airport on November 19 by H.R.H. the Duke of Gloucester during the Royal Tour which included a State visit to Ethiopia. The Chief Kadi, Sheikh Mohamed Sirad, in welcoming His Royal Highness said that the building marked an important phase in the progress of the country.

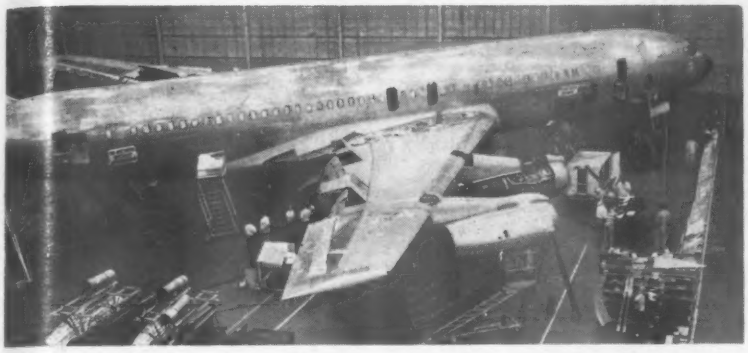
The only alternative to air travel from Hargeisa is a journey of about 100 miles over a rough track road to the nearest port, Berbera, and consequently there has been a steady increase of air traffic during recent years which has made the proper handling of aircraft and passengers a difficult task. Air movements during 1957 were almost double those of 1956.

The Somaliland Protectorate Controller of Civil Aviation is Mr. R. M. Bell. Mr. R. E. G. Trembath, of International Aeradio, Ltd., acts as Airport Manager and Air Traffic Controller, and Hargeisa is another typical example of I.A.L.'s World-wide activities.



H.R.H. the Duke of Gloucester takes the salute at Hargeisa following a display by a troop of Somali horsemen.

ews of Aircraft, Engines and Missiles



SEATTLE PRODUCTION.—The first Boeing 707-320 Intercontinental now nearing completion will be used for C.A.A. flight-test and certification before going into service with Pan American World Airways.

NAVY MISSILES.—The Martin Co.'s Orlando division, Florida, has been awarded a $20.4-million contract for the production of Bullpup ASMs for the U.S. Navy.

MULTOPLAN NEWS.—The Argentine Civil Air Ministry has ordered an RW-3 Multoplan from Rhein-Flugzeugbau, of Krefeld-Uerdingen; an order from Mexico is being negotiated, and another of this type is being delivered to Denmark.

In Time for Christmas

MORE than 250 well-chosen illustrations constitute the third edition of "THE AEROPLANE Pictorial Review," recently published by Temple Press Limited.

This is a fascinating record of aeronautical progress over the past year, suitable for aviation enthusiasts of all ages and covers every sphere of aviation. There are sections on: New Shapes of 1958; Commercial Aviation; Utility and Light Aircraft; Missile Parade; Fighter Cavalcade; Bombers—Heavy, Medium and Light; Aircraft Afloat; Research Aircraft; A Miscellany of Military Aircraft; Rotary Round-up, and Faces and Places.

This book, containing 126 pp., 10 in. by 7½ in., can be obtained from all bookstalls and booksellers, price 10s. 6d., or direct from the publishers at Bowling Green Lane, London, E.C.1, price 11s. 9d., including postage.

SPACE CALCULATOR.—A circular space-propulsion calculator has been produced by the General Electric flight-propulsion laboratory, Cincinnati, 15, Ohio. The calculator allows the thrust, specific impulse, exhaust velocity, propellent consumption and beam power to be determined for chemical and nuclear rockets, plasma jets, photon rockets, ion drives and magneto-hydrodynamic propulsion systems. On the reverse side of the calculator satellite information is given. For a selected altitude above any planet in the solar system the calculator gives orbital and escape velocities, period of revolution and gravitational force.

BLACKBURN ELECTRONICS.—Blackburn and General Aircraft, Ltd., is to design and manufacture industrial electronic equipment for such applications as data handling, control and instrumentation. A new organization for this purpose has been formed at Brough under Dr. Harry Fuchs.

MAX HOLSTE REVIVAL.—The prototype Max Holste M.H.152, which first flew in 1951 and was not developed, is to be fitted with a 400-h.p. Turboméca Artazou turbojet. It will be used at Pau-Idron for test purposes.

SIKORSKY THOUSAND.—The 1,000th S-58 was rolled off the Sikorsky Aircraft assembly line on November 12. Production started in 1954. The type is now being evaluated by the U.S. Navy for towing disabled boats, and techniques for mine-sweeping are being developed.

ROTARY RECORD.—The helicopter height record of 10,984 m. set up by M. Jean Boulet (France) in an S.E.3150 Alouette, F-ZWVB (500-h.p. Turboméca Artouste III engine), on June 13 has now been officially confirmed by the F.A.I.

SATELLITE DELAY.—No further attempts will be made to launch U.S. satellites with Vanguard rockets before the end of the IGY on December 31. A study is being made to improve the reliability of all satellite vehicles and no further launchings will be made until this is complete.

NO DEBATE YET.—Last week in the House of Commons Mr. R. A. Butler, Leader of the House, said that it would be difficult to find time to have a debate before Christmas on the future of the aircraft industry. A motion has been tabled proposing that financial aid should be given to the aircraft industry by the Government so as to prevent the sale of "certain outstanding new inventions in the field of aeronautics" to foreign powers.

SEASLUG TRIALS.—The R.N. guided-weapons ship "Girdle Ness" has completed her programme of firing trials and evaluation of the Armstrong Whitworth Seaslug SAM in the Mediterranean, and was due to return to Devonport on November 26.

STRATOFORTRESS NEWS.—The last Boeing B-52F was rolled out from the Seattle factory on November 14 as the B-52G began its flight-test programme at the Wichita Division, where all future B-52s will be produced.

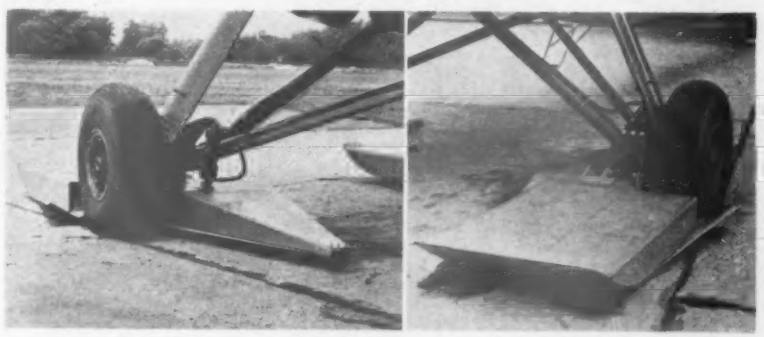
HIGH-FLYING HARE.—A new U.S.A.F. missile, the Hare, will cruise at 900 m.p.h. at an altitude of 60 miles. It will be powered by a ramjet which produces thrust through the recombination of the monatomic oxygen in the atmosphere. At high altitude ultra-violet radiation breaks oxygen molecules down into single atoms; these give out energy when they recombine on a catalytic surface. Gold promises to be the best catalyst.

BOEING FINANCE.—For the nine months ended September 30, 1958, the Boeing Airplane Company's sales amounted to $1,276,095,539 (about £460m.); the corresponding figure for 1957 was $1,068,149,816 (about £385m.).

NATO SATELLITE.—Senator Jackson, chairman of the NATO Scientific and Technical Committee, said on November 21 that NATO planned to put an Earth satellite in orbit by 1960.

JODEL NEWS.—The Société Aéronautique Normande, which is turning out the two-seat D.117 Jodel at the rate of nine a month, is about to begin producing the D.100 three-seat version known as the Ambassadeur. Five will be built each month; delivery time is six months. The first four-seat D.140 Mousquetaires, briefly described in THE AEROPLANE of September 26, will be delivered to customers before the end of this year.

PARIS NEXT YEAR.—The 23rd French International Air Show will be held at Le Bourget Airport, Paris, from June 12 to 21.



WATER SKIS.—Right, two views of the "Universal Landing Gear" developed by All-American Engineering of Georgetown, Md., and fitted to a U-1 Otter of the U.S. Army. These water skis allow the aircraft to taxi from water on to land and vice versa.

Howard Levy photographs

Commercial Aviation Affairs

HELIPORT COMMITTEE.—Under the auspices of the C.A.A., a joint industry/Government committee has been set up in the U.S.A. to establish criteria for the design and development of heliports. The first meeting was held on October 31.

ATLANTIC CABLE PROPOSED.—An ICAO meeting of 14 nations concerned with air navigation facilities in the North Atlantic area is to consider a jointly financed transatlantic cable to improve point-to-point communications. The scheme would replace the proposed forward-scatter system, which does not meet all the technical specifications.

COLLINS F.C.S. FOR T.C.A.—An order for Collins Flight Control Systems and VHF co.nmun.cat.ons navigation equipment has been placed for T.C.A.'s Vanguards.

P.A.A.-N.A.L. AGREEMENT.—The United States C.A.B. has granted temporary approval for the exchange of stock and equipment between Pan American and National Airlines. Permanent agreement has been withheld pending a more complete study by the C.A.B.

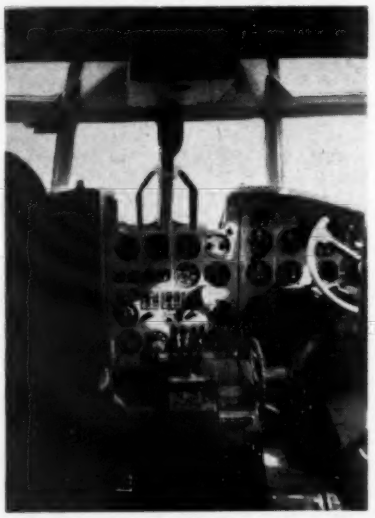
AIR INDIA FREIGHT SERVICE.—On November 15 Air India International inaugurated a weekly all-freight service between London and Bombay calling at Düsseldorf and Zürich. It is operated by Super Constellations of Seaboard and Western Airlines under charter.

ANGLO-SPANISH EXPANSION.—Enlarged opportunities for services between and through the U.K. and Spain will be offered to British and Spanish operators as a result of recommendations to the respective Governments following joint negotiations in Madrid earlier this month.

AUSTRALIAN STRIKE. — On November 21, Australian Airline Pilots' Association began a series of rolling strikes against the domestic and international airlines. Starting with T.A.A., the principal airlines are being subjected to three-day strikes in turn, in support of the association's claim for higher salaries.

STRIKES OFF AND ON.—The strike of Capital Airlines' mechanics ended on November 20 after a new offer by Capital had been accepted by the International Association of Machinists. On November 21, 6,700 I.A.M. employees of T.W.A. went on strike, and Eastern on November 24. All T.W.A. flights were grounded.

NEW YORK INTERNATIONAL.—New pictures of New York International Airport at Idlewild appear on page 784. These show particularly well the arrangement of the runways used for jet operations. The reference in the caption to Runway 25 being mandatory refers, of course, only to jet aircraft.



ILYUSHIN VIEWS.—Two new photographs from Moscow show the Ilyushin Il-18 in Aeroflot markings, and the cockpit of the same aircraft. It is reported from Prague that C.S.A. is to purchase Il-18s for their medium-range routes.

News About People

TRANSPORT POST.—Mr. L. J. Dunnett, C.B., C.M.G., Deputy Secretary (A) at the M.o.S., is to take over the position of Deputy Secretary at the M.T.C.A. in charge of inland transport matters. He will supersede Mr. P. Faulkner, who is to assume responsibility for shipping matters.

B.W.I.A. CHANGE.—Sir Errol dos Santos has relinquished his post as chairman of B.W.I.A. after eight-and-a-half years and has become president of the airline in succession to Sir Gerard d'Erlanger. Mr. H. O. B. Wooding, Q.C., is acting chairman of B.W.I.A. until a new appointment is made.

CANADIAN DIRECTORS.—The newly elected board of the Air Industries and Transport Association of Canada, which was installed in office at Quebec City on November 5, during the holding of the 24th Annual Convention. Left to right, front row, R. M. Kendall, C. H. Dickins, J. E. Morley, R. W. Ryan (past-president), and W. G. Bracken. Back row: P. Y. Davoud, A. Bandi, W. B. Pitfield, W. H. Wheeler, . Scholefield and C. F. Burke.

MISSILE MEN.—Mr. A. Sewart has been appointed assistant general manager (missiles) of Avro's Weapons Research Division; he has been with A. V. Roe since 1925 and prior to his new appointment was the company's production controller and works manager. Mr. R. W. Ward becomes chief development engineer of the Weapons Research Division; he joins A. V. Roe from Glosters, where he was deputy technical director.

R.A.F. APPOINTMENTS.—Air Cdre. C. Scragg, C.B.E., A.F.C., is to become Air Officer Commanding, No. 23 (Training) Group on December 1, 1958, with the acting rank of Air Vice-Marshal. Air Cdre. Scragg's present post of Director of Operational Requirements (B) at the Air Ministry is to be taken over by Air Cdre. R. N. Bateson, D.S.O., D.F.C., on December 15.

NEW DIRECTOR.—The Viscount Prestwood has been made a director of Aerovisors, Ltd., of High Wycombe, designers and manufacturers of aircraft ground-servicing equipment.

CANADIAN LOSS.—Mr. Russ Baker, president of Canada's third largest airline, Pacific Western Airlines, died suddenly in Vancouver last week.

NA.39 TESTING.—Capt. E. D. G. Lewin, a director of Blackburn and General Aircraft, is to assume responsibilities in connection with flight-testing of the NA.39 strike aircraft at Holme-on-Spalding-Moor aerodrome. Mr. J. Hall, manager of the experimental department, takes over as manager of the aerodrome, in succession to Sqn. Ldr. A. Firth, who has been temporary manager. The third NA.39 flew at Holme on October 31.

SERVICE RECOGNITION.—Mr. W. A. S. Lloyd (right), architect-in-charge of the reconstruction of St. Clement Danes church, was presented with the C. P. Robertson Memorial Trophy by Sir Lionel Heald, chairman of the Air Public Relations Association, on November 19.

FILTON VISITOR. — The Federal German Deputy Defence Minister, Dr. Josef Rust (extreme right) visited Bristol Aircraft, Ltd., and Bristol Aero-Engines, Ltd., recently and saw Britannia production lines and Orpheus and Olympus engines on test. With him (second right) is Sir Matthew Slattery, chairman of Bristol Aircraft, Ltd.

IATA APPOINTMENTS.—Sir Gerard d'Erlanger, chairman of B.O.A.C., and Mr. Ake Rusck, president of S.A.S., have been elected to the IATA executive committee in succession to Major J. R. McCrindle and Mr. Per A. Norlin.

DOUGLAS EXECUTIVES.—Within the Douglas Aircraft Co., Mr. F. W. Conant, vice-chairman of the board, has also been made senior vice-president, manufacturing, and Mr. A. E. Raymond is appointed senior vice-president, engineering. New vice-presidents are Messrs. E. F. Burton, director of transport aircraft systems engineering; E. H. Heinemann, director of combat aircraft systems engineering; E. P. Wheaton, director of missiles and space systems engineering; J. L. Jones, general manager, Tulsa division, and S. P. Smith, general manager, Charlotte division. Mr. Ira C. Eaker, vice-president, Eastern offices, has been elected to the board following the resignation of Mr. F. E. Hines. Mr. Nat Paschall, vice-president, sales, replaces Mr. Hines on the executive committee.

TEAL APPOINTMENT.—Sir Hudson Fysh, chairman of Qantas, has been appointed vice-chairman of Tasman Empire Airlines, Ltd. He has been a director since 1940.

ROYAL HONOUR.—The Order of Independence, First Class, Jordan's highest decoration, has been awarded to Wg. Cdr. J. Dalgleish by King Hussein for "services rendered to me and my country on November 10." Wg. Cdr. Dalgleish, who is Air Adviser to the Jordanian Government, was acting as co-pilot to the King when their Dove was intercepted by MiG fighters over Syria. They were forced to return to Jordan.

Military Aviation Affairs

NORSTAD NEWS. — The Supreme Allied Commander, Gen. Lauris Norstad, recently said that within 10 years half of the NATO air force strength will be in missiles, and about 40 NATO squadrons are being replaced by guided-weapons units. Manned aircraft would always be needed, however, because strike decisions must be made in the air as well as on the ground.

NEW PIONEER ROLE.—The only Prestwick Pioneer squadron operating in the United Kingdom—No. 230 (Sqn. Ldr. J. Simpson, D.F.C.) based at R.A.F. Dishforth—is to undertake a new rôle, supply-dropping. Its aircraft have recently been modified by Scottish Aviation so that containers can be pushed through the door space. Early next year No. 230 Sqn. is to be re-equipped with Twin Pioneers, when its pilot and ground-crew complement will be doubled.

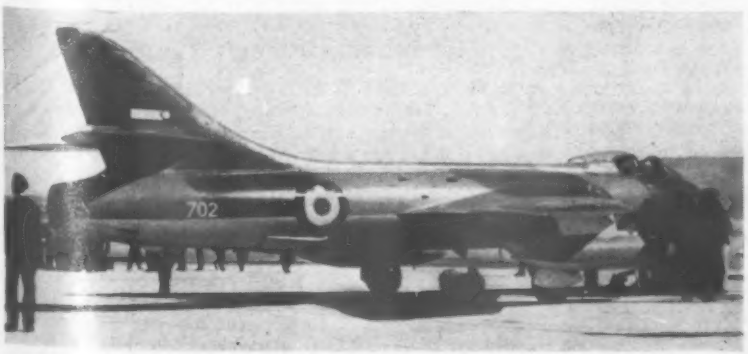
WELL DONE.—Sir John Hunt congratulates a group of A.T.C. cadets after they had received the Duke of Edinburgh's Gold Award from His Royal Highness at Buckingham Palace on November 18.

MAGISTER SALE.—Six CM.170 Magister trainers (Turboméca Marboré II) have been ordered by Austria from the Potez-Air Fouga Co.

NORDIC ALOUETTES.—The Swedish Ministry of National Defence has ordered 10 more Alouette IIs, eight for the Navy and two for the Air Force. Deliveries are to begin before the end of this year.

RESERVES CLUB.—Membership of the R.A.F. Reserves Club is now open to serving officers of the R.A.F. at the normal subscription rates: town members, £5 5s.; country members, £2 12s. 6d.; overseas members, £1 1s. Details of the club's facilities and membership application forms can be obtained from the secretary, Mr. H. C. Room, M.B.E., 14 South Street, Park Lane, London, W.1. (Tel., Grosvenor 1738.)

SSAFA DISPLAY.—An application made by the Soldiers', Sailors' and Airmen's Families Association to revive the Whit-Monday air display at Yeadon aerodrome has been granted by the Leeds and Bradford Joint Aerodrome Committee. Yeadon is to be derequisitioned at the end of this year and taken over as the Leeds/Bradford civic airport.



AMMAN ARRIVAL.—This Hawker Hunter F.6 in Royal Jordanian Air Force markings is one of 12 being supplied to Jordan under the American off-shore procurement programme.

Air Transport

Bahamas Changes

THE purchase by Mr. David Brown and Mr. Eric Rylands of an 80% holding in Bahamas Airways may well be a pointer towards changes in B.O.A.C.'s attitude towards its subsidiary companies.

Bahamas Airways has been controlled by the Corporation or, earlier, by B.S.A.A. since January, 1949; it was formed in 1936. Mr. David Brown is chairman and managing director of David Brown and associated companies and was previously chairman of Skyways, of which Mr. Rylands is managing director. Mr. Brown will be chairman of the re-formed company, and B.O.A.C., which retains a 20% interest, will continue to be represented on the board.

The company will continue to operate inter-island services, but will replace the D.H. Herons with DC-3s and will take over the services, for which B.O.A.C. holds the rights, between Nassau and points in Florida in addition to Miami.

Blind Landings for B.E.A.?

FEW airline operators will have failed to appreciate the significance to them of the automatic landing system perfected by the Blind Landing Experimental Unit at Bedford, and demonstrated recently (see THE AEROPLANE, October 17, pp. 591-593). The general advantages of operations being independent of the weather are too obvious to need recounting here, but British European Airways, as an exclusively short-haul airline, stands to gain more than most operators from automatic landings. The greater the number of landings to be made, the worse the effects of bad weather prove to be on punctuality and regularity. This has an adverse effect both on operating cost and standard of service.

It is no surprise, therefore, to find B.E.A. eagerly anticipating the use of automatic landing systems in their next-generation aeroplanes (such as the Airco D.H. 121) even if this equipment cannot at first be used right down to "zero-zero" conditions. Lord Douglas makes the point, in the current *B.E.A. Magazine*, that a technical and operating problem of this magnitude cannot be solved in a single step, nor by the airlines alone. He calls for discussions in this country between the airport authorities, research departments and companies interested in developing the equipment. Agreement is also needed in ICAO on the ground component of the system.

ICAO Recommendations

AT the end of a 25-day session in Montreal, the ICAO Rules of the Air, Air Traffic Services and Search and Rescue Division reached a number of conclusions which bear upon the special needs and characteristics of jet aircraft. Like all ICAO recommendations, the report of the Division now has to be considered by the 73 member organizations before it can come before the Council for final approval; the Air Navigation Commission will also review the report.

Among the many items on the agenda, the following subjects were considered, and recommendations were made as indicated.

Visual Flight Rules.—A moderate increase is suggested (from five to eight km. or three to five miles) in the flight visibility requirements under VFR. All operations above 6,000 m. (20,000 ft.) in controlled airspace should be under ground control, with careful co-ordination of civil and military flying.

Collision Avoidance.—A new rule is proposed to replace the existing "right of way" rule, as follows:— "When two aircraft are converging, both aircraft shall give way by turning away from the threat of collision."

Separation Minima.—Horizontal separation minima are limited to the present values by the accuracy of available navigational aids. Vertical separation (305 m. or 1,000 ft. at present) should be doubled, above a level to be determined by regional agreement but, in any case, below 8,850 m. or 29,000 ft.

Flight Plans.—Mandatory filing of flight plans should be extended from IFR in controlled air space to cover all flights within advisory routes or areas, and other areas as required by ATC. Flight plans should be filed before take-off. The form of the ICAO standard flight plan was revised.

Automation.—The Division proposed a set of broad principles to ensure that the systems being developed in different countries will be compatible so that full advantage of automatic air traffic control equipment can be derived in co-operation between area traffic control centres.

Mexican Melting-pot

IN order to compete more effectively with U.S. and other operators, two of Mexico's airlines have combined their services. A complete merger between Aeronaves de Mexico and Compania Mexicana de Aviacion does not seem likely at present, but the Mexican Government is known to be seeking a rationalization of the country's airlines, of which there are at present six operating scheduled services.

One result of the Aeronaves/Mexicana agreement is the transfer of the former's two Britannia 302s to the latter company's Acapulco—Los Angeles non-stop route, from November 21. On this route, the Britannias will be competing with Western Air Lines' DC-6s. The purchase of additional Britannias for Aeronaves and/or Mexicana is, we understand, under consideration.

According to *Aviation Daily*, Mexicana has meanwhile standardized on the DC-6 for its trunk operations and has obtained three more of these from Panagra, making seven in all. Three DC-7s have been sold to Northwest Airlines, which requires additional equipment on the route to Miami starting on December 1.

Airwork Consolidate

ON November 19 Airwork, Ltd., concluded an agreement with Morton Air Services and Olley Air Services whereby the two latter companies become part of the Airwork group. This move follows the acquisition by Airwork last January of a substantial interest in Air Charter, Ltd., and Aviation Traders. Other Airwork subsidiaries include Transair, Ltd., and Straits Air Freight Express in New Zealand.

Associated with the latest move are reports—possibly premature but not entirely unfounded—that the Airwork group may change its name. British United Airlines has been suggested as a possibility.

The names of Morton and Olley are among the best known in British private airline operations. In recent years the two companies have joined forces to operate scheduled services from the U.K. to the Channel Islands, Le Touquet and Rotterdam, and special charter flights. The present fleet comprises a Heron, six Doves, two Consuls and three Rapides.

Airwork, Ltd., has a fleet of two Viscount 700s, four Hermes and five Vikings, with which it operates the Safari Colonial Coach service to East and Central Africa, tourist service to Ghana, and trooping services to the Far East, in addition to special charter contracts of various kinds. Two Viscount 831s are on order.

Transair, Ltd., has three Viscount 804s and 10 DC-3s, with which it flies trooping services to Gibraltar, Malta and North Africa; scheduled mail and newspaper services to France, Germany and the Channel Islands; and seasonal inclusive tours.

Air Charter have a Britannia 307, three DC-4s, six Avro Super Traders, and nine Bristol 170s. Operations include trooping to Cyprus, Christmas Island and elsewhere, air freighting to Australia, special passenger charter services and the Channel Air Bridge passenger and vehicle ferry.

Canadian Hearings Continue

AIR TRANSPORT BOARD hearings into the application by C.P.A.L. for transcontinental route rights in Canada were adjourned on November 20. Since October 20, when hearings began, the Board has sat on 20 days; the hearings will resume on December 1.

Almost the whole of the time so far has been taken up by witnesses for C.P.A.L. and T.C.A. The evidence has been mostly concerned with the suggested inefficiency and inadequacy of T.C.A. service, the traffic available on the routes in question, and C.P.A.L.'s ability to provide the service they propose.

Earlier this year the Canadian Minister of Transport announced a revision of Government policy to allow domestic competition if economically acceptable. Mr. Stephen Wheatcroft, in an independent study for the Government subsequently showed there was little scope for competition with existing traffic. (See THE AEROPLANE, August 22.)

RED TURBOPROP.—This new illustration of the prototype Antonov An-10 transport shows the end plate fins which have been added since the type first appeared in 1956. The An-10A production model, with accommodation for 100 passengers, is expected to be in service soon; the An-16 has a lengthened fuselage and seats 130.

North Atlantic Traffic

FIGURES issued by IATA show that the number of passengers on the North Atlantic route in the third quarter of 1958 (July-September) increased by 35.2% over the total in the same period of 1957, which was the previous record quarter. The increase did not, however, match the 39.4% boost in available seats which resulted from greater frequencies and increased capacities in existing and new aircraft types.

Of particular interest is the break-down of traffic figures between first-class, tourist and economy classes. The last-mentioned category accounted for 68.5% of all passengers on the route. The extent to which the airlines were correct in their forecast of economy-class traffic is shown by this comparison, on a percentage basis, of seats offered and revenue passengers carried:

	First.	Tourist.	Economy.
Seats offered	18.4%	14.8%	66.8%
Passengers carried	16.6%	14.9%	66.5%

In the table alongside the total number of flights includes 539 all-cargo operations. The division of passenger flights was: first-class, 708; tourist, 21; economy, 1,878; mixed, 7,107. Of the freight total, 33.8% was carried on the all-cargo flights, which also accounted for 16.2% of the mail. Similar statistics for the first and second quarters of 1958 were in THE AEROPLANE for September 12, p. 415.

NORTH ATLANTIC TRAFFIC—3rd QUARTER, 1958.

	EAST-BOUND	WEST-BOUND	TOTAL	% Change 1957
Scheduled flights	5,098	5,155	10,253	+25.4
Seats offered	338,749	350,077	688,826	+39.4
Revenue pass.:				
First	34,180	43,443	77,623	—
Tourist	28,425	41,028	69,453	—
Economy	126,344	193,473	319,817	—
Total	188,949	277,944	466,893	+35.2
Pass. load factor, % ..	55.4	79.1	67.3	−2.1
Freight, kg.	3,434,783	3,161,538	6,596,321	+33.0
Mail, kg.	1,434,453	1,069,136	2,503,589	+19.2

Licensing Civil Air Transport

SPEAKING at the B.I.A.T.A. dinner on November 12 (see THE AEROPLANE last week) the Minister of Transport and Civil Aviation said, "I think there are attractions in the idea of a new Air Transport Advisory Council with new powers . . . it may be that the constitution of such a body is within the Minister's power." The Minister was referring to the suggestion that operators of public air services should be licensed. He went on to admit that the introduction of further licensing into British aviation would be highly controversial. The argument would be that aircraft and aircrews had to be licensed; why should further licensing be necessary?

What, in fact, is the position and what are the Minister's powers? Subject to one reservation it seems clear that Mr. Watkinson has all the power he needs under the Civil Aviation Act of 1949. The first section charges the Minister with the general duty of organizing and encouraging civil aviation development and providing safety and efficiency.

Section 8 provides for the general regulation of air navigation by Order in Council. By this means the Queen may make such provision as appears requisite or expedient "as to the conditions under which passengers and goods may be carried by air and under which aircraft may be used for other commercial, industrial or gainful purposes. . . ." The section is, however, much wider than this and includes aircraft registration and airworthiness, control of aerodromes, the safety and efficiency of air navigation, of aircraft and the persons and property carried therein.

Specific powers for the licensing of air transport and commercial flying are conferred by Section 13 of the Civil Aviation Act. The Queen, by Order in Council, may make regulations "for securing that aircraft shall not be used in the United Kingdom by any person

1. For plying while carrying passengers or goods for hire or reward on such journeys or classes of journeys (whether beginning or ending at the same point or different points) as may be specified in the Order or

2. For such plying undertaken for the purpose of any trade or business as may be specified except under the authority of, and in accordance with, a licence granted to the said person by the licensing authority specified in the Order."

The section also includes powers to decide the circumstances in which such licences may be granted, refused, revoked and so on, as to methods of appeal, conditions, the rendering of information and fees. It is clear, therefore, that the Act contains full licensing powers and it is, perhaps, rather curious that they have never been invoked since the Act was passed.

There is, however, one reservation, as mentioned earlier. It is not entirely certain that the powers conferred by S.13 embrace the licensing of airlines flying in or out of the United Kingdom on international services. The words used rather suggest that the power is restricted to United Kingdom flying only. But it is likely that the Ministry would interpret the Act without any restriction just as, under the similar pre-war Act, an Order was made extending it to the Channel Islands. And if it is accepted that the power to license extends to aircraft flying in and out of the United Kingdom it will also cover United States aircraft and aircraft generally which are subject to the Chicago Convention.

Equally there seems to be no reason why the Minister should not reconstitute the A.T.A.C. with wider powers and terms of reference if he sees fit. Under S.12 of the Act the Council has the duty of advising on any question referred by him relating to air transport charges or facilities anywhere in the World and questions which, in his opinion, require consideration with a view to the improvement of air transport services.

Finally, it should be noticed that action under the licensing section, S.13, is subject to Parliamentary review. Drafts of the Orders in Council, which would be the means of putting the section into effect, would have to be laid before Parliament. They would only become effective on an Address from both Houses praying that an Order should be made in terms of the draft.—LAURENCE WEBLEY.

NEW YORK INTERNATIONAL

These pictures of New York International Airport, not previously published, illustrate the state of development three months ago. The picture immediately above shows the terminal area with the International Building in the centre foreground and the control tower immediately behind. Parallel to the front face of this terminal area is Runway 25, 8,200 ft. long. Use of this is mandatory when conditions permit, with the instrument Runway 22 (7,840 ft.), (horizontal in top picture), as second choice. The long Runway 13R/31L. (9,500 ft. and 11,000 ft. soon) parallel to the shore of Jamaica Bay, can be used only when Runways 25 and 22 are unusable. (See also THE AEROPLANE for October 17, p. 530.)

Sabreliners for the U.S.A.F.

UNITED STATES AIR FORCE has decided to order an initial production batch of seven North American Sabreliner trainer/transports under the designation T-39. The Sabreliner, which made its first flight at Palmdale on September 16, 1958, was built as a private venture to meet a U.S.A.F. requirement for a combat readiness trainer. This requirement, known as the UTX, with that for a utility jet transport (the UCX), was laid down in August, 1956, when the U.S.A.F. said that it had insufficient funds to back development of a new design, but would be happy to evaluate any prototypes the manufacturers cared to produce on a "fly before we buy" basis.

The order for the Sabreliner is the first placed as a result of this decision. Although it is believed that Beech offered the Morane Saulnier MS.760 Paris and at least one other project was submitted, North American was the only company to build a prototype of a brand-new design for the UTX requirement. So far as the UCX is concerned, Lockheed have built and flown two Jetstars and McDonnell are said to be nearing completion of their Model 119. There is some uncertainty over availability of funds at the present time, but the U.S.A.F. will presumably choose, eventually, between these two types. Another possible UCX, the Fairchild 185, was abandoned by that company in order to concentrate on the F-27.

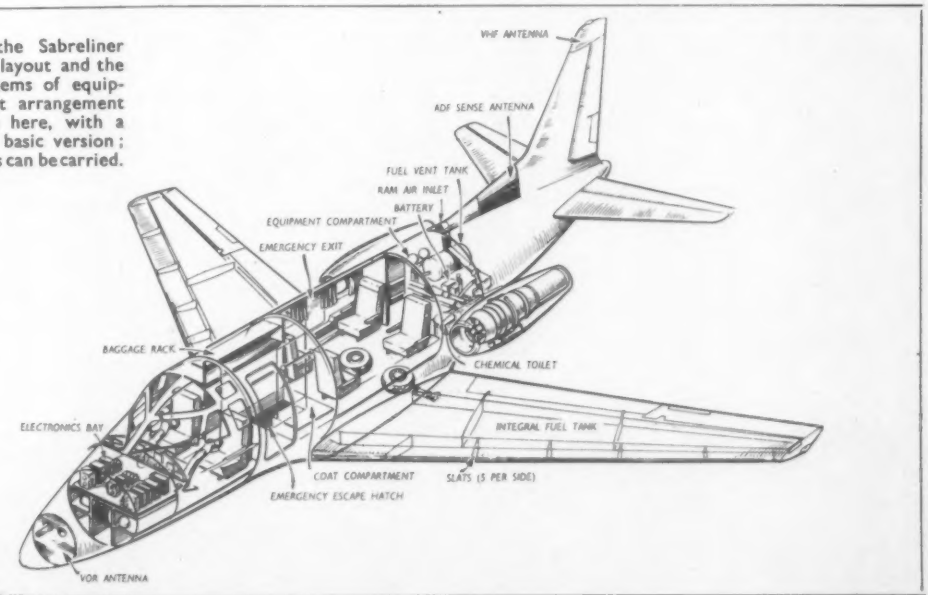
The terms "combat readiness trainer" and "jet proficiency trainer," both applied to the Sabreliner, may need explanation. The thought behind this type of aircraft is that there are many "desk flyers" in the U.S.A.F. who need to keep up their jet ratings, and few types of aircraft are available to enable them to do this. The UTX has the performance of a reasonably advanced (subsonic) combat jet aeroplane, coupled with good economy and transport capability—so staff officers can keep their hand in on jets while flying from one important meeting to another.

Project design of the Sabreliner, or N.A.246 as it was at first known, was completed during the autumn of 1956 and production design began on October 1 in that year. The company were able to use, in the project design stage, the results of a major design investigation into small jet or turboprop transports which had been completed a year or two previously. The design chosen for development featured a low wing—passing under, rather than through, the fuselage—with two General Electric J85 turbojets mounted in and above the wing roots.

Wind-tunnel tests of this design showed that the engine installation was unsatisfactory, there being high interference between the intakes and the leading-edge slots on the wing. On July 1, 1957, redesign was initiated to raise the wing into the fuselage and move the engines back to their present position. The shape of the wing was altered at the same time to increase the root chord and the area, providing additional fuel capacity.

When news of the Sabreliner was first given by the company, a first-flight target date "early in 1958" was mentioned. This was later put back to the middle of the year, with a target roll-out date in May. This latter target was bettered by a week or so, when the completed prototype was rolled out at the company's Inglewood factory on Los Angeles International Airport on May 8. At that time, however, it was without engines, and delays in delivery of the General Electric J85 kept the prototype on the ground for more than a month after the target flight date. Soon after the roll-out, and before the engines had been installed, THE AEROPLANE had the opportunity to inspect the prototype at Los Angeles and discuss its features with Mr. Fred Prill, project engineer for this aircraft.

We were impressed, at that time, by the small size of the Sabreliner—span, 42 ft.; length, 43 ft.; and gross weight, 15,300 lb.—which in no way detracted from the aircraft's utility or prevented the inclusion of various advanced engineering features. In the prototype the cabin is arranged for four passengers in individual armchairs and the flight-deck seats the crew of two side-by-side; a chemical toilet closet is provided at the rear of the cabin. This will be the basic arrangement, but



An impression of the Sabreliner showing its general layout and the location of major items of equipment. The four-seat arrangement of the cabin shown here, with a toilet behind, is the basic version; up to eight passengers can be carried.

The prototype Sabreliner in flight. Now that a U.S.A.F. order has been placed, the type may be offered for executive use also.

alternative layouts have been prepared to seat five, seven or eight passengers by deleting the toilet and reducing baggage space. Other rôles in which the Sabreliner could operate include transportation of small, high-priority spares; navigation training, target towing or "chase" flying for experimental aircraft.

The Sabreliner's wing is built in one piece and is a two-spar structure with integral fuel tanks over the whole span. Sweepback is 28¾°, measured on the quarter-chord line. Basic material used in the wing is 75ST aluminium alloy, with machine-milled skins.

The fuselage is largely made up of 24ST alloy, the skins being chemically milled. It is a separate entity from the wing and is pressurized by AiResearch equipment to a differential of 8.8 p.s.i. Cabin conditioning equipment is contained in a special bay at the rear of the fuselage behind the engines, accessible from ground level through a hatch in the underside. Also located here are the hydraulic pumps, which power a 3,000-p.s.i. system to operate the undercarriage, brakes, speed brake and nosewheel steering.

Two engine-driven generators provide the basic 28-V DC electric system. The engines can be started from the nickel-cadmium batteries or from an external source. The windscreen is de-iced electrically; de-icing of wings, tail unit, inlet duct and guide vanes is by hot air.

Electronic equipment is contained in a bay in the fuselage nose, where it is easily accessible. The engines, likewise, can be easily serviced through panels or removed bodily through large doors in the underside of each nacelle. A major portion of the engine-compartment structure is of titanium for fire protection.

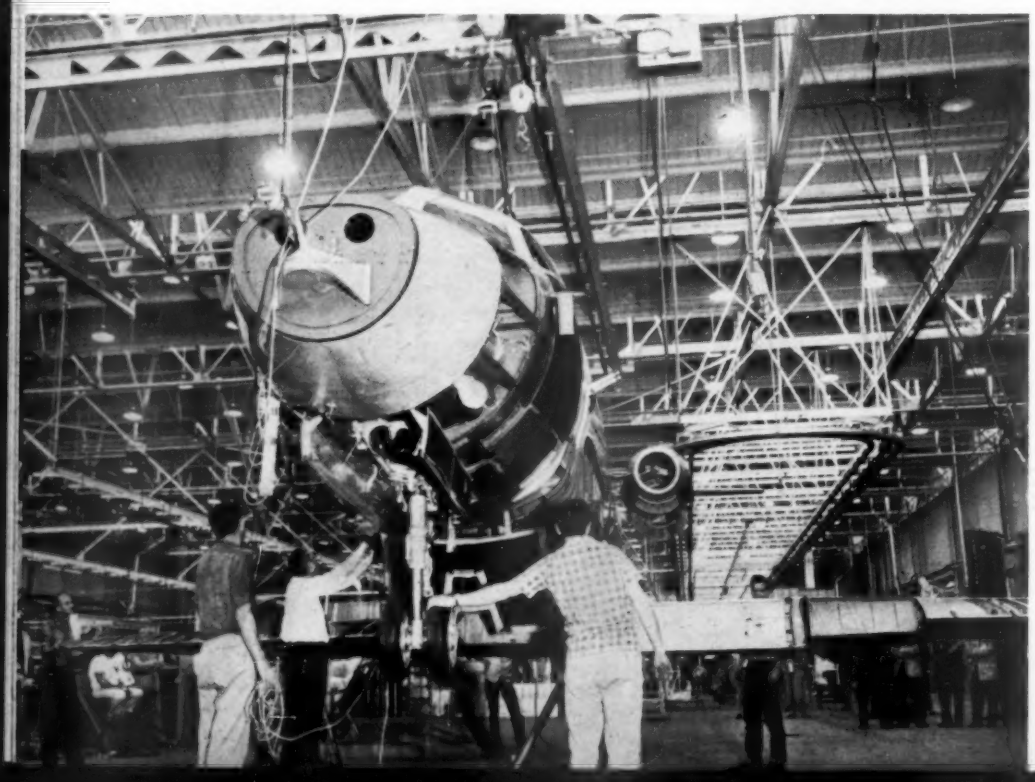
Access to the cabin and cockpit is through a single plug-type door in the port side ahead of the wing, this door incorporating air steps. An emergency escape hatch, 20 in. by 32 in., is in the floor between cabin and cockpit, immediately aft of the speed brake—which is extended automatically by an hydraulic accumulator when the hatch is raised. Layout of the cockpit itself will no doubt be modified to suit U.S.A.F. needs; in the prototype all controls and instruments are so located that the Sabreliner can be flown solo from the left-hand seat. A Collins integrated flight director system is fitted.

Standard fuel capacity is 700 Imp. gallons in the wing tanks, but this can be extended by the use of slipper tanks on the wings. When these are fitted, the inboard leading-edge slat sections are de-activated; normally the slats over the whole leading edge operate in five separate portions each side. A one-point pressure refuelling system is provided.

The Sabreliner has a design cruising Mach limit of 0.76 and a limiting diving speed of Mach=0.85. The required range is 1,500 st. miles and optimum operating altitude will be around 40,000 ft. Although the prototype Sabreliner has J85 engines of about 2,500 lb. s.t. each, the company has not so far indicated whether these engines will be retained in the T-39. At the time of our visit the 2,900-lb. s.t. Pratt & Whitney JT-12 was being viewed with much favour and is a likely choice for future aircraft.

Although the number of aircraft involved in the U.S.A.F. order is small, the contract has been welcomed by North American as a stabilizing influence on employment at its Los Angeles division, where production of the F-100 is scheduled to end next year. Although North American is involved in development of two of the most advanced U.S.A.F. projects—the F-108 and B-70 Valkyrie weapons systems—these will not require a large work force on the floor for several years.

It has been North American's policy to keep out of the civil aircraft field as long as military contracts could be maintained. The Sabreliner is recognized, however, as having a good potential for the civilian market as a high-speed executive transport, and in this connection North American can point to a market survey they have conducted in the executive field showing an average load of 3½ passengers and a demand for high speeds. In conformity with the U.S.A.F. requirement, the aircraft has been designed and built to the dictates of CAR-4b and SR422.—F.G.S.



The Sabreliner under construction. This picture shows the fuselage being lowered onto the one-piece wing. Production sequence for the T-39 may differ somewhat from that used for the hand-made prototype.

The Fleet Air Arm

"A Superb Potentiality"

Photograph copyright "The Aeroplane"

Vice-Admiral Sir Manley Power, K.C.B., C.B.E., D.S.O., writes—

"AS Deputy Chief of Naval Staff and Fifth Sea Lord I find great pleasure and privilege in having the opportunity of introducing this special issue of THE AEROPLANE, devoted, as it is, to a review of the Fleet Air Arm: pleasure, because as the member of the Board of Admiralty responsible for the Fleet Air Arm it is encouraging to see a particular issue being devoted to an integral part of the Navy which is likely to achieve even more importance in the future; privilege because I know that the readers of THE AEROPLANE are likely themselves to be experts in aeronautical matters.

"I am certain that all will find a considerable interest in this present issue, whether it be in the technical aspects of the articles or in the broader strategic implications.

"It would be absurd for me to try to develop, in this short preface, the various technical aspects embodied in this issue. What I would wish to touch upon is the broad strategical aspect of the Fleet Air Arm—and its implications.

"The Fleet Air Arm is an integral part of the Royal Navy and a major factor in its strength both in offence and defence. The functions of the Navy, the world-wide deployment of power in support of our National policy does not change, but its weapons do. The gun, supreme for centuries, gives place to the aircraft and the guided missile.

"Increasingly in this brave new world the versatility of the aircraft in conjunction with the ubiquity of the aircraft carrier has an important rôle as much in support of land operations as over the sea. Until the guided missile can be taught to think and differentiate its targets there will be no substitute for the skill and intelligence of aircrew and no cessation of the need for the best aircraft we can give them.

"There is certainly no lack of the necessary skill and ingenuity to design and build the aircraft. Equally the skill, courage and enthusiasm of the Fleet Air Arm has never been higher. We have in the Fleet Air Arm a superb potentiality which must never be allowed to decline."

The Fleet Air Arm —its Tasks and Structure

UNDER the new pattern of defence for the United Kingdom and Commonwealth laid down during the past two years the Royal Navy is to play an ever increasing part both in the event of a global nuclear war or in limited hostilities. To meet this task, together with the introduction of new equipment and the new economies outlined in this year's Navy Estimates, the Service is at present going through a transition period in which the emphasis is on the development of the sea-going fleet.

In its adaptation to these conditions and the general policy of greater mobility and immediate readiness for the fleet the nucleus of the new Navy will continue to be the aircraft carrier. Its versatility is a reflection of the versatility of the Navy as a whole and it is the centre of strike forces for use against ships or in support of land operations, in addition to providing a base for fleet defence.

For these tasks the Royal Navy will in future consist of two main groups. The first will be an Eastern Fleet, including an operational carrier, to be kept east of Suez. To assist other Commonwealth Navies this group will also have provision for a commando carrier equipped with helicopters. The other group is to be operated in the NATO areas of the Atlantic and Mediterranean and have two operational carriers at sea with a third in reserve.

The carriers west of Suez will have a greater proportion of anti-submarine aircraft as their chief job will be to keep the sea lanes open. East of Suez, the carrier will have a larger fighter/strike potential.

At the Admiralty the fighting efficiency of the Fleet Air Arm, including operational tactics and technical policy, is the responsibility of the Fifth Sea Lord, and Deputy Chief of Naval Staff, an appointment at present held by Vice-Admiral Sir Manley Power, K.C.B., C.B.E., D.S.O. Directly under the Fifth Sea Lord comes the Director of Air Warfare (Capt. R. E. N. Kearney, O.B.E.), who is responsible for aircraft and aircraft equipment requirement policy and adviser on aircraft accidents; and the Director of Air Organization and Training (Capt. T. W. B. Shaw, D.S.C.). The last-named is also responsible to the Second Sea Lord and Chief of Naval Personnel for training through the Director of Naval Training.

Responsibility for ensuring that the Fleet Air Arm's air material requirements are met and that such air material operates satisfactorily in service is the Aircraft Department's controlled by the Director-General, Aircraft. Directly under the Third Sea Lord, this department comprises an Air Equipment and Naval Photography Division and an Air Maintenance and Repair Division. It also contains an Air Armament Section and an Air Radio Section. The Ministry of Supply has the task of meeting the requirements of the Director-General, Aircraft, and its Deputy Controller of Aircraft is normally a naval officer.

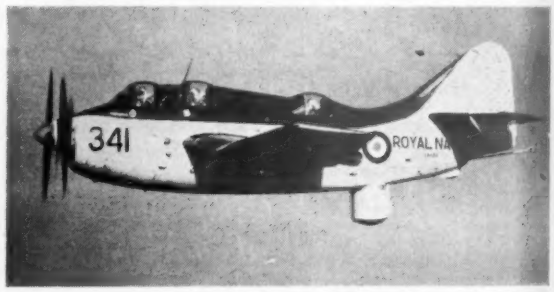
Implementation of the overall policy laid down on naval aviation by the Admiralty is the responsibility of the Flag Officer Air (Home) for all naval air stations in the United Kingdom and the Flag Officer Aircraft Carriers for all operational carriers through the appropriate commander-in-chief.

The Operational Carriers

To ensure the positioning of two carriers west of Suez and one to the east, the Admiralty is planning on four carriers—"Victorious," "Eagle," "Ark Royal" and "Hermes"—with three in operational service and one on refit or trials at any one time. In addition, two carriers—"Albion" and "Centaur"—will be placed in the fleet operational reserve. "Bulwark" will become the commando carrier.

At the present moment the "Victorious" (37,000 tons) and "Eagle" (53,000 tons) are operating with the Mediterranean Fleet and the "Albion" is serving east of Suez. The "Eagle" is due for a long modernization refit and until "Hermes," now under construction, is completed "Centaur" (27,000 tons) is filling the gap in the operational fleet, from early next year. "Bulwark," of the same tonnage, is now home for conversion to its new rôle, which is expected to take about a year. "Ark Royal" (53,340 tons) is undergoing a long refit at Devonport, and is due to rejoin the Fleet late in 1959.

The capacities of the four planned carriers will be different.



Photograph copyright "The Aeroplane"

The Fairey Gannet has been replaced in all but one of the first-line anti-submarine squadrons of the F.A.A. by Westland Whirlwind helicopters. A modified Gannet, however, is due to enter service next year on airborne early-warning duties.

H.M.S. "Ark Royal" with a D.H. Sea Vixen landing on, during the trials of the new all-weather fighter. The carrier is now undergoing a refit at Devonport.

Replenishment at sea. H.M.S. "Eagle" in company with R.F.A. "Retainer" during the transfer of 150 tons of ammunition and provisions in 8½ hr. "Eagle" is operating with the Mediterranean Fleet.

but after the refits are completed their equipment will be similar, providing them with roughly parallel operating standards of aircraft and radar.

General service at sea in the Royal Navy is now limited to one year. To conform with this each carrier in turn will operate with escorts as a Task Group eight months east of Suez, then change on station (Singapore) with the relieving carrier. Each carrier will spend six months in dock on refit every two years.

With the current system of permanent commissioning of Fleet Air Arm squadrons, as opposed to the old system of disbanding squadrons at the end of a carrier's 18-month commission, the carrier and flying personnel of an Air Group are continuously changing so that approximately one third are posted every eight months. To fulfil the anti-submarine rôle west of Suez each carrier Air Group is to consist of one strike squadron, two anti-submarine squadrons, one all-weather fighter squadron and four airborne early warning (AEW) aircraft. East of Suez an Air Group is to have two strike squadrons, only one anti-submarine squadron, one all-weather fighter squadron and four AEW aircraft.

Tactical changes have been accompanied by alterations in aircraft equipment, and Wyverns and Gannets have already been withdrawn from all but one front-line and anti-submarine squadrons, respectively. The new aircraft types planned to be operated by the three Air Groups are the Supermarine Scimitar F.1 for the strike rôle; the de Havilland Sea Vixen FAW.1 equipped with Firestreak air-to-air missiles for all-weather defence; the Fairey Gannet AEW.3 for the airborne early warning rôle and the Westland Wessex for anti-submarine duties. The Scimitar, now entering service with operational squadrons, will be replaced by the Blackburn NA.39 strike aircraft when the latter is ready for service. The Sea Vixen, due to become operational in June of next year, will replace the Sea Venom, and the Gannet AEW.3 is also planned to supersede the Skyraider in 1959. The Whirlwind HAS.7 is to be replaced by the Wessex within the next two years.

When the Skyraider and Whirlwind have been superseded by the new aircraft there will be no piston-engined types in carrier service and the requirement for petrol bunkering will cease. The replacement of the Skyraider will also end the operation of American aircraft by the Fleet Air Arm.

Naval Aviation Ashore

All Naval air stations and establishments in the United Kingdom come under the overall control of the Flag Officer Air (Home), who has his headquarters at R.N.A.S. Lee-on-Solent. Responsible for recruiting and training personnel and equipping and maintaining operational squadrons and other units for service in the sea-going carriers, Home Air Command is at present commanded by Vice-Admiral Sir Walter Couchman, K.C.B., C.V.O., D.S.O., O.B.E. Under his command are the Flag Officer Reserve Aircraft (Rear Admiral A. J. Tyndale-Biscoe, O.B.E.) at R.N.A.S. Arbroath, and the Flag Officer Flying Training (Rear Admiral D. R. F. Cambell, D.S.C.) at R.N.A.S. Yeovilton.

Under the changes announced in the Naval Estimates for 1958-59 the tasks of the Command are being concentrated into larger groups at fewer bases and eight air establishments

Supermarine Scimitar F.1s of No. 807 Squadron are at present working-up at R.N.A.S. Lossiemouth. Replacing the Sea Hawk in the strike rôle, the Scimitar is now operated by two front line squadrons.

Photograph copyright "The Aeroplane"

are to be closed over the next three years. Two stations —Anthorn and Stretton—have already been closed; R.N.A.S. Ford and Bramcote are to be closed early in 1959; R.N.A.S. Eglinton is to close in March, 1959; R.N.A.S. Brawdy, a parent to a number of day-fighter squadrons, may be closed in 1960, but kept in reserve; the Air Electrical Training Establishment, Worthy Down, is to close in 1960, and its task transferred to R.N.A.S. Lee-on-Solent; and the Aircraft Repair Yard at Donibristle will be closed by the end of next year.

This means that the air stations remaining open after 1961 will consist of Yeovilton, Lossiemouth, Culdrose, Abbotsinch, Arbroath, and Lee-on-Solent, together with the aircraft yards at Belfast and Fleetlands. In addition, a small part of the Home Air Command task will be accommodated at R.N.A.S. Hal Far, Malta. The more important work of these air stations and establishments is described in the following section.

R.N.A.S. LEE-ON-SOLENT.—Commanded by Capt. A. F. Black, D.S.C., Lee-on-Solent (H.M.S. "Daedalus") is, in addition to the long-established headquarters of Home Air Command, the home of a number of specialized units. These include No. 705 Squadron, the helicopter conversion school; No. 781 Communications Squadron; the Naval Air Maintenance Unit; the Naval Air Radio Installation Unit; the Flight Deck Machinery Trials and Training Unit; and the Accident Investigation Unit. The air station is also the test flight airfield for Fleetlands Aircraft Yard.

No. 705 Squadron (Lieut. Cdr. G. W. Bricker) has been the Services' Helicopter Conversion School since May, 1947. Pilot conversion consists of 20 hr. on the Hiller HTE-2, including 2 hr. night flying, and 30 hr. (2 hr. at night) on Whirlwind 1s and 3s. At the end of these 50 hr., which takes 11 weeks, a pilot is fully converted and operational for the search and rescue rôle.

Further tasks of the Squadron are the helicopter crewman-course for Naval ratings; local A.S.R. with one helicopter, and the maintenance of a V.I.P. helicopter. In January next year, No. 705 is moving to R.N.A.S. Culdrose which is to become the parent station for all helicopter squadrons.

Flying senior officers to and from Home Air Command, operating the United Kingdom Naval "clipper service" between the various air stations and undertaking light-twin conversion courses are the main tasks of No. 781 Squadron commanded by Lieut. Cdr. J. S. Barnes. Equipped with six D.H. Devons the Squadron last year flew 250 hr. per month.

The Naval Air Maintenance Unit, a lodger unit from the Admiralty, undertakes the production of servicing schedules for all new aircraft joining the Fleet Air Arm. The Naval Air Radio Installation Unit, on the other hand, undertakes the design and construction of aircraft electronic installations for such purposes at Service trials, fleet and Squadron exercises and equipment evaluation.

Responsible for carrier flying trials, dead-load trials and flight deck crew training, the Flight Deck Machinery Trials and Training Unit at Lee-on-Solent deals with arrester gear, catapult, emergency barrier gear, aircraft refuelling systems and oxygen equipment on a carrier. The Accident Investigation Unit covers any type of accident where there is some doubt of the cause.

Above, Naval airmen receiving instruction on ejection seats at the Safety Equipment and Survival Training School at Seafield Park.

Right, the new one-piece aircrew immersion suit developed at Seafield Park by the R.N. Air Medical School.

Photographs copyright "The Aeroplane"

SEAFIELD PARK.—Located near Lee-on-Solent is Seafield Park, the home of the R.N. Air Medical School, the Central Air Medical Board, the Naval Aircraft Maintenance Examination Board, the Safety Equipment and Survival Training School and the Naval Aircrew Advisory Board.

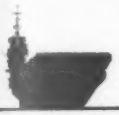
The Air Medical School deals with a variety of work concerning Naval flying, and also instructs aircrew and doctors on air medical problems. Its equipment includes a cold-water tank for testing immersion and sea-survival gear; two high-altitude decompression chambers, interconnected for explosive decompression; and an ejection-seat rig. The school is now in the process of developing a one-piece immersion suit to replace the present two-piece unit.

Aircrew survival courses, the training of Naval airmen,

(*Continued on page* 791)

Hillers, Whirlwinds and Dragonflies of No. 705 Squadron at R.N.A.S. Lee-on-Solent. The F.A.A. Helicopter Conversion School since 1947, the Squadron is being transferred to R.N.A.S. Culdrose in January next year.

A D.H. Sea Venom FAW.21 of No. 738 Squadron from the Naval Air Fighter and Strike School at R.N.A.S. Lossiemouth on a 15° R/P training sortie.



(*Continued from page* 790)

safety equipment workers and instruction in safety equipment for aircrew and equipment officers are the main responsibilities of the Safety Equipment and Survival Training School. The school is also concerned with the development of dinghies both for aircrew and ship personnel.

R.N.A.S. LOSSIEMOUTH.—The home of the Naval Air Fighter and Strike School and the shore base for a number of front-line day-fighter squadrons, Lossiemouth (H.M.S. "Fulmar") is commanded by Capt. F. M. A. Torrens-Spence, D.S.O., D.S.C., A.F.C. In addition to the School, the air station houses an Aircraft Holding Unit and a helicopter search and rescue section, and has recently become a Master Diversion Airfield.

The flying task at Lossiemouth is undertaken by three training squadrons—Nos. 736, 738 and 764—and for the moment one operational squadron—No. 807—which is working up with Supermarine Scimitars.

All day and all-weather-fighter pilots under training for the Fleet go to the Naval Air Fighter and Strike School from No. 1 F.T.S. at R.A.F. Linton-on-Ouse. At Lossiemouth, day-fighter pilots go to No. 736 Squadron for the first part of this operational training and then transfer to No. 738 Squadron for armament instruction. All-weather pilots, on the other hand, go straight to No. 738 for both phases of the course.

No. 736 Squadron (Lieut. Cdr. J. D. Baker) has, at the present time, three tasks and three different types of aircraft to satisfy them. To begin with, as already recorded, the Squadron operates the first part of the School's day-fighter course which includes Sea Hawk familiarization, tactical formation flying and camera gunnery. Pilots also complete a number of day and night navigation exercises and learn the basis of tactical reconnaissance and Army support. Second of the Squadron's tasks is jet conversion and instrument flying training in Vampire T.22s both for students and other pilots on the air station.

Finally, No. 736 have two Hunter T.8s on a temporary basis for swept-wing conversion for Scimitar pilots, and high-speed instrument flying training. To fulfil this varied programme the Squadron has nine instructors who include six Q.F.I.s, one air warfare and two tactical instructors.

As the "finishing school" for all student fighter pilots in the Service, No. 738 Squadron (Lieut. Cdr. R. J. McCandless, D.S.C.) serves 11 front-line squadrons, which include almost all the day-fighter and several all-weather units. Day-fighter pilots from No. 736 Squadron receive training in 15° and 45° R/P, dive bombing, strafing and air-to-air firing on the banner and also undertake navigational flights and other sorties. All-weather pilots from No. 1 F.T.S. complete both sections of the day-fighter operational course with No. 738 Squadron flying Sea Venom FAW.21s solo, without an observer.

In the New Year a number of changes are to take place between Nos. 736 and 738 Squadrons. All day-fighter pilot training covering both sections of the course will be undertaken by No. 736 Squadron; and all-weather instruction, plus the Vampire T22 instrument flying will be the tasks of No. 738 Squadron. This is designed to conform with the overall increase in all weather fighter training in the Fleet Air Arm.

No. 764 Squadron (Lieut. Cdr. D. T. McKeown), also known as the Advanced Weapon Training Squadron, operates four main courses of instruction with Sea Hawks. The first of these is the Air Warfare Instructors' course for experienced, above average, squadron pilots who receive a 10-week period of practical instruction at Lossiemouth following four weeks of theory at the Gunnery School at Whale Island. Comprising approximately 110 sorties in 80 hr. flying, the course covers air-to-air firing, day and night dive-bombing, R/P and strafing, divisional attacks and the briefing and leading of armed strikes.

Second of the courses operated by No. 764 is for C.O.s and senior pilots designate of front-line squadrons. A four- to six-week course, it includes similar flying to the first course but on a reduced sortie scale.

The third task is the Front Line Armament Practice Section (F.L.A.P.S.). For this, No. 764 Squadron provides Air Warfare Instructors to conduct front-line squadrons through intensive armament practice training courses. Finally, the Squadron runs a refresher flying course for pilots.

During next year No. 764 Squadron is to be re-equipped with five Hunter T.8s and four Scimitars in addition to its

The second F.A.A. front line Scimitar squadron—No. 807—was re-formed at Lossiemouth on October 1 and is due to embark on H.M.S. "Ark Royal" next year.

Photographs copyright "The Aeroplane"

At R.N.A.S. Lossiemouth day-fighter pilots receive their operational training from Nos. 736 and 738 Squadrons on Armstrong Whitworth Sea Hawks. Armament instruction includes dive bombing, illustrated here by a Sea Hawk FGA.4.

Sea Hawks. It will then operate swept-wing conversion courses for its own students and for experienced Sea Hawk pilots on to the new strike fighter. Each conversion course will total 50 hr. flying coupled with a number of hours in an Air Trainers Link Scimitar simulator which is already in use at Lossiemouth.

Reformed on October 1 and under the command of Lieut. Cdr. K. A. Leppard, No. 807 Squadron is at present working up with its Scimitars and a Hunter T.8, and will remain at Lossiemouth for some time developing tactics. It is to embark on H.M.S. "Ark Royal" later next year. Scimitar operation from "Victorious" is described elsewhere in this issue.

The Aircraft Holding Unit at Lossiemouth, commanded by Lieut. Cdr. D. G. Bourne, has a number of tasks and deals with nine aircraft types, including the Scimitar, Hunter T.8, Meteors T.7, NF.11 and TT.20, and Sea Devon. Its work covers the receipt of new or second-hand aircraft from contractors or Naval Aircraft Yards and checking them for Service use; the inspection and modification of aircraft returned from user units, the modernization of certain types, and the holding of aircraft awaiting disposal from the Service.

R.N.A.S. YEOVILTON.—Commanded by Capt. D. B. Law, M.B.E., D.S.C., Yeovilton (H.M.S. "Heron") is the headquarters of the Flag Officer Flying Training, and is the Naval All-weather Fighter station. The station is the base for No. 766 Squadron (the Naval All-weather Fighter School); No. 700 Squadron and No. 700 "Y" Flight; and also the parent unit for four operational all-weather squadrons. These are No. 809 (Lieut. Cdr. A. A. Knight) at present on "Albion"; No. 891 (Lieut. Cdr. L. A. Jeyes) just off "Bulwark"; No. 893 (Lieut. Cdr. E. V. H. Manuel) on "Victorious"; and No. 894 (Lieut. Cdr. W. G. Black) on "Eagle".

No. 766 Squadron (Lieut. Cdr. J. F. Blunden) has been the Naval All-weather Fighter School since October of last year, when naval observer training ceased at the R.A.F. all-weather O.C.U. at North Luffenham. Then at Merryfield, No. 766 Squadron moved to Yeovilton in January.

Under the recently introduced scheme, observers come to the school from Culdrose and first complete a seven-week course before crewing-up with a pilot and starting the 14-week all-weather crew training syllabus. Pilots, of whom two-thirds have completed one or more front-line tour on Sea Hawks, go straight on to the 14-week course.

Formed on November 4, No. 700 "Y" Flight under the command of Cdr. M. J. H. Petrie is to undertake the Service flying trials of the D.H. Sea Vixen. These are designed to prove the reliability of the airframe, engines, radar and associated equipment under operational conditions. For this

Aircraft based at R.N.A.S. Yeovilton, the Naval All-weather Fighter station, include (below) this first D.H. Sea Vixen FAW.1 of No. 700 "Y" flight and (right) D.H. Sea Venom FAW.21s of No. 766 Squadron.

Left, still in service in limited numbers with the F.A.A. for special duties are radar-carrying TBM-3 Avengers of World War II vintage. Below, soon to be replaced by Fairey Gannet AEW.3s, the MDAP-supplied Douglas AD-4W Skyraiders of No. 849 Squadron have given excellent service with the Royal Navy since 1950.

task a high degree of flying intensity is required, and the Flight is also instructed to test the operational capabilities of the aircraft in three rôles—all-weather fighter, ground attack and strike.

For this work No. 700 "Y" is to be equipped with six production aircraft, but at present is operating one early production Sea Vixen FAW.1 for crew familiarization. The first of the production aircraft is expected at the end of this year. Six aircrews, including the C.O., have been posted to the Flight and the groundcrew complement is based on a combination of Sea Venom (electronic) and Scimitar (engine and airframe) numbers.

During the intensive flying trials, which are due to take six months and last until the middle of next year, the Flight will be evaluating the complete weapons system. This will include firing trials of Firestreak and the 2-in. air-to-air rockets, and the low-level strike equipment which is to be fitted in two aircraft.

At the end of these trials, the first operational squadron will be formed around the crews of No. 700 "Y" Flight with Cdr. Petrie as the C.O. After working up, the squadron will be ready to join the Fleet.

Before then, a short spell of sea trials from a carrier is expected to be completed by No. 700 "Y" Flight, in May of next year. This will be the first occasion that a Service Sea Vixen will go on board.

R.N.A.S. CULDROSE.—This large West Country air station (H.M.S. "Sea Hawk"), which is commanded by Capt. H. S. Barber, is in the throes of a major re-organization which will result, from January onwards, in its becoming the main helicopter centre of the Fleet Air Arm. It will be the parent station for every helicopter squadron, whose aircraft will be based there when disembarked from carriers, and it will also be the centre of naval rotary-wing training. At the same time it will continue some of its present fixed-wing functions, so that there will be an intensive flying task divided more or less equally between these aircraft and the helicopters.

Culdrose already has a very varied aircraft complement, since at the time of writing it houses No. 750 Squadron with Sea Princes for observer training; No. 831 Squadron, with veteran Avengers and Sea Venom FAW.21s for special duties; the H.Q. flight of No. 849 Skyraider Squadron; a Sea Balliol flight for piston-engined conversion; and a station flight of Dragonfly and Whirlwind helicopters. It also accommodates the Observer Training School.

No. 750 Squadron (Lieut. Cdr. E. T. Genge) is responsible for the flying task of the O.T.S., for which it is equipped with 12 Hunting Sea Prince T. Mk. 1s, carrying an extensive array of radio and radar gear. Flying for basic observer training at Culdrose was formerly shared between Nos. 750 and 796 Squadrons, the latter with Gannets, which were withdrawn on September 1 when Part One of the observer syllabus was changed. The present commitment at Culdrose involves 75 hr. flying in Sea Princes for pupil observers, during 17½ weeks, on radar and navigational exercises.

No. 750 Squadron also undertakes a certain amount of general communications flying and, since the withdrawal of the Gannets, has been given an additional search and rescue task for which one Sea Prince is always on daylight stand-by, carrying marine markers and other special equipment. With one or two night flying exercises per week, these jobs keep No. 750 Squadron pilots in the air for up to 50 hr. per month each.

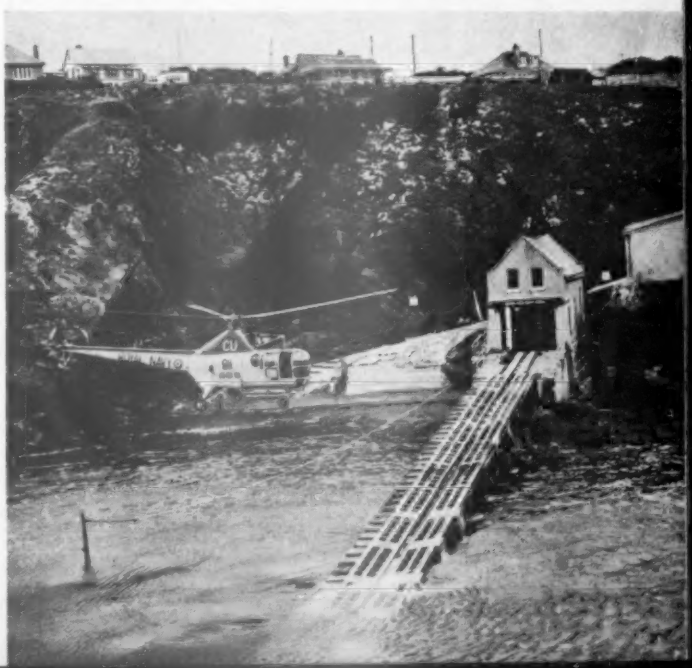
Little can be said about the activities of No. 831 Squadron (Lieut. Cdr. W. J. Hanks), which has detached flights elsewhere, but both its Avengers and Sea Venoms carry comprehensive radar equipment. The time-honoured Avengers are soon to be replaced by Gannet AS.4s after many years of sterling service.

and the squadron also has one or two Sea Vampire T.22s and Gannet T.5s for instrument training, etc.

One of the longest-term residents at Culdrose is the H.Q. of No. 849 Squadron (Lieut. Cdr. F. Bromilow, an observer), which is the largest of all naval air squadrons with an establishment of 30 Douglas AD-4W Skyraiders. Its primary task is airborne early warning for the fleet, for which it is divided into A, B, C and D Flights, each with four aircraft on board one of the commissioned carriers. At the time of writing, A Flight is on H.M.S. "Eagle" in the Mediterranean, B is on "Victorious" in the same area, C is on "Albion" east of Suez and D recently disembarked at Culdrose from "Bulwark."

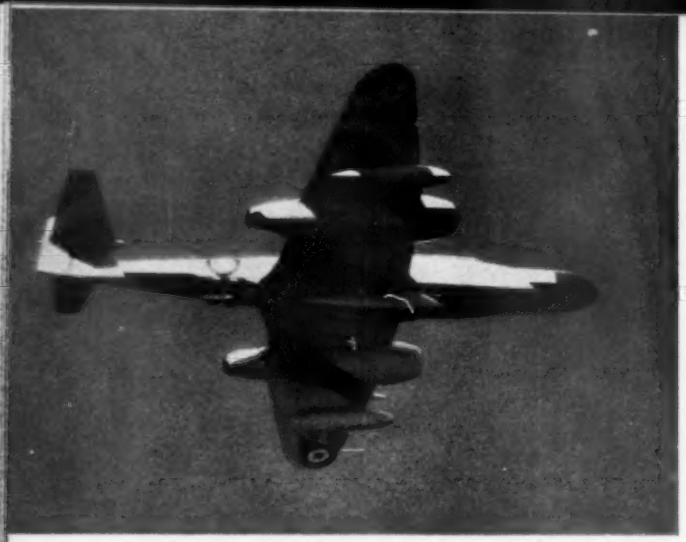
The H.Q. Flight at Culdrose administers these detached units, and is also responsible for training pilots in AEW operations, conducting special trials, etc. In addition to AEW, the squadron tasks include anti-submarine search, long-range surface search and strike direction in all types of weather conditions, performed very efficiently by the very powerful APS-20 ship's-type radar carried under the belly of the Skyraider. This is so powerful that it will also pick up cloud formations over long ranges, so that the AD-4W is additionally suitable for weather reconnaissance duties.

Fifty Skyraiders were received under the American mutual aid programme by the Royal Navy for AEW duties at the opening stages of the Korean War in 1950 to equip the Culdrose-based squadron. So reliable in service have these



Co-operation of search and rescue facilities between the Royal Navy and the civil authorities is symbolized by the proximity of this winch-equipped Dragonfly helicopter from Culdrose to the lifeboat slipway at the Lizard.

Photographs copyright "The Aeroplane"



Modified from Meteor NF.11 fighters of the R.A.F., Meteor TT.20s recently replaced Short Sturgeons for target-towing with No. 728 Squadron at Hal Far, Malta.

aircraft been over the past eight years that all but three or four are still available for operation, although their equipment is now beginning to show symptoms of old age. The Skyraiders in detached flights spend 13 months at sea, and then return to Culdrose for overhaul and modernization, which are done on the squadron.

Operating a flying radar platform, the Skyraider pilot's job is to fly as straight and level as possible when on search, and although the auto-pilot is available for some operations, very accurate flying is required. The squadron aims to turn out pilots ready for deck-flying by day or night, and training includes a spell in the observer's cabin to gain an appreciation of this aspect of the job. As all naval pilots are now jet-trained so far as advanced flying is concerned, a brief piston conversion course is given to potential Skyraider pilots on Sea Balliol T.21s at Culdrose.

Early next year, the first Fairey Gannet AEW.3s will be received by the Fleet Air Arm to replace the Skyraiders, having similar radar, but with a better performance. An experimental unit, No. 700 "G" Flight, will be formed for intensive flying trials of the Gannet 3, after which 849 Squadron will re-equip. Two of its observers are already attached to the Fairey Aviation Co. to observe the initial development of this promising new aircraft.

The station flight of A.S.R. Dragonflies and a Whirlwind, which are commanded by Lieut. Cdr. D. Elliott and are kept very busy rescuing holidaymakers in the summer, were recently joined by the first helicopter squadron arrivals, in the form of No. 845 Squadron, disembarked from H.M.S. "Bulwark." They are due to be followed by the Whirlwinds of No. 824 Squadron from "Victorious." In January, the Hiller HTE-2s, Dragonflies and Whirlwinds of No. 705 Squadron are due to move to Culdrose from Lee, to continue training all naval helicopter pilots.

To avoid interference with the jet circuit at Culdrose, the helicopters will do most of their training exercises at Predannack, the satellite to Culdrose.

R.N.A.S. HAL FAR (H.M.S. "Falcon").—Particular importance attaches to Hal Far (Capt. J. A. Ievers, O.B.E.), which since the closing down of Sambawang in Singapore is the only overseas land station operating in the Fleet Air Arm. Its location on Malta gives it a position of great strategic importance in the Mediterranean, and it provides a base for all units disembarked from carriers in that area. Excellent range facilities are available from Hal Far, so that intensive armament training can be undertaken by squadrons on their arrival.

Except for the Fleet Requirements Units, which provide target-towing aircraft for the air firing programme, Hal Far inevitably has a greatly fluctuating population, and a recent visit by THE AEROPLANE coincided with one of the quieter periods. At times, however, Hal Far is one of the busiest airfields in the entire F.A.A., and its use is complicated by the very limited air space available for civil and military traffic over Malta.

The main Maltese airfield at Luqa, with its R.A.F. and civil movements, is very close. But because of the better approaches over the sea, Hal Far is the primary diversion base.

Main residential unit at Hal Far is No. 728 Squadron (Lieut.-Cdr. R. Trellawney), which is the Mediterranean Fleet Requirements and Communications Unit, and therefore has a wide variety of tasks. Its two Sea Devons operate transport services over a surprisingly widespread route network, to such places as Gibraltar, Cyprus, Turkey, Venice and the U.K., sometimes in connection with NATO commitments, but its primary equipment now comprises Meteor TT.20s for towing sleeve or flag targets.

The Meteors are adapted NF.11s with M.L. winching units mounted above the starboard wing root linked with target containers beneath the rear fuselage. They recently arrived to replace the veteran Short Sturgeon target tugs at Hal Far.

The additional towing speed of the Meteors should greatly assist in raising the air gunnery standards of visiting squadrons. For more advanced weapons, represented by the Firestreaks, which are now with the Mediterranean Fleet, B Flight of No. 728 Squadron operates pilotless Firefly "drones" from Hal Far, as described in detail elsewhere in this issue.

Only recently redesignated as an operational unit at H.M.S. "Falcon," No. 848 Squadron (Lieut.-Cdr. G. C. J. Knight, D.F.C., R.N.) was originally formed in January, 1958, as C Flight of No. 728 Squadron and was renumbered on October 13. The Flight was formed, following experience with naval helicopters in the Suez campaign, as a trials unit at Lee-on-Solent with the Westland Whirlwind, to develop amphibious and vertical envelopment techniques and provide the nucleus of a force for eventual embarkation on the commando carrier (H.M.S. "Bulwark").

Four American-built Cyclone-powered Whirlwind HAS.22s were initially received from No. 845 Squadron's former equipment, and with the Asdic gear removed, provided an excellent lifting capacity. They were ferried out to Malta by aircraft carrier in February, when the flight personnel flew out by commercial airline, and after their arrival, began intensive trials with the 3rd Commando Brigade of the Royal Marines.

The Whirlwinds are ferried around the Mediterranean on cruisers or in tank landing craft (which can carry up to 12 rotorcraft) but these must unload the helicopters on to the shore before they can operate. From aircraft carriers, of course, immediate operation is possible.

Exercises with NATO forces took place in Tripoli, Sardinia and elsewhere, also the Flight operated in Cyprus for six weeks on anti-terrorist sorties. Great progress was made towards the development of a highly mobile commando helicopter force for "fire brigade" duties, and training was extended to include night and instrument flying.

Despite the age of the M.D.A.P. aircraft, excellent serviceability has been achieved, but the squadron is looking forward to eventual re-equipment with the Westland Wessex. This should double the present available load of 6-7 troops or 2,000 lb. with a small fuel load, and will also carry light vehicles. In the meantime, gun-firing trials are to be conducted from No. 848 Squadron's increased establishment of Whirlwinds, which are standing by in Malta for immediate use anywhere in the Mediterranean.

R.N.A.S. ARBROATH.—Commanded by Capt. G. W. Tanner, Arbroath (H.M.S. "Condor") is the headquarters of the Reserve Aircraft Sub-command under the Flag Officer Reserve Aircraft (Rear Admiral Tyndale-Biscoe, O.B.E.) and the Mechanical Training Establishment of the Fleet Air Arm. For this second rôle, the station is responsible for the training of artificers and naval airmen except those in the radio and electrical branches.

The Flag Officer Reserve Aircraft is responsible to the Flag Officer Air (Home) for the preparation for service, the storage, modification and repair of all reserve aircraft in the United Kingdom, and for their supply to the Fleet and to units of the Home Air Command. The work of the Reserve Aircraft Sub-command falls broadly under two main headings—the holding task and the repair task. The first task is to maintain reserve aircraft and engines; followed by the issue of replacement aircraft and engines to squadrons in the U.K. and overseas units; the reception of used aircraft; the control of all transfers of aircraft and engines between units; and the maintenance of records of all aircraft and engines throughout their Service life.

In its second task—repair—the Command supervises the repair of aircraft, engines and other components using the resources of the Naval Repair Organization and the Civil Repair Organization.

For the holding task the Command's establishment and units include one aircraft holding station—R.N.A.S. Abbotsinch—and three aircraft holding units, one each at Lossiemouth, Culdrose and Fleetlands. Repair task establishments consist of three aircraft yards at Fleetlands, Donibristle and Belfast; one mobile aircraft repair and salvage unit based at Abbotsinch, and one aircraft transport and salvage unit based at Worthy Down (H.M.S. "Ariel").

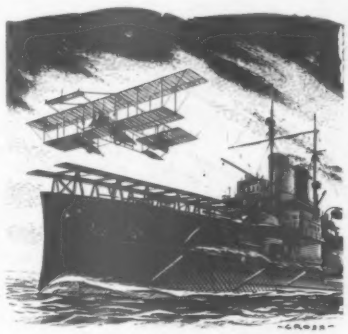
Absorbing the training task from R.N.A.S. Bramcote on the 10th of this month, R.N.A.S. Arbroath is now the centre for all mechanical and ordnance training for ratings of the Fleet Air Arm. In addition the new entry and airmanship training of naval airmen is being transferred from Bramcote to Arbroath.

Naval Aviation's Background*

AS long ago as July, 1908, the post of Naval Air Assistant was created at the Admiralty and there began the long and close association of the Royal Navy with aviation. This year, then, British naval aviation can lay claim to have attained its half-century. It also happens that this year, too, the Admiralty's present specialized air branch can celebrate its coming of age, for it was in 1937 that after a somewhat chequered history control of the Fleet Air Arm finally came to be vested in the Royal Navy.

It is appropriate that in this issue we should say something about the development of Britain's naval aviation over the years. Our purpose here, however, is not to present a detailed history, but to give some of the principal stages and steps and outstanding events from 1908 to the present day.

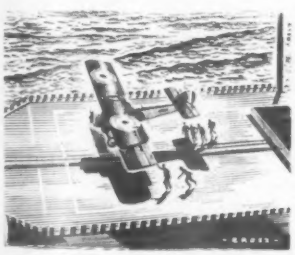
In those very early days it was the lighter-than-air craft that held favour as a vehicle for naval air purposes. Four years were to pass before the aeroplane was demonstrated in a convincing manner to be suitable for operation from water and from ships—two essential qualifications if they were to operate successfully with the Fleet.



First British flight from a ship under way.

The first step in this direction was taken on November 18, 1911, when Cdr. Oliver Schwann succeeded in taking-off in an Avro biplane from the surface of the water at Barrow-in-Furness; his craft was powered by a 35 h.p. Green engine. Two months later, on January 10, 1912, in Sheerness harbour, Lieut. (later Cdr.) C. R. Samson took off in a Short S-27 pusher biplane from a platform on the foredeck of the anchored H.M.S. "Africa"; the aircraft was fitted with pontoon floats. A further major step towards shipboard aircraft operation was taken on May 9 of the same year when Lieut. R. Gregory flew a Short S-27 from a launching ramp on the forward deck of H.M.S. "Hibernia" steaming at about 10 knots in Weymouth Bay. These three historical flights laid the foundations for naval aviation as we know it today.

During the course of 1912, the Royal Navy accomplished some notable experiments with its aircraft. These included the first bomb dropping—a 100-lb. dummy, by Cdr. Samson from a Short seaplane—and the transmission of wireless signals, also from a Short seaplane. By the end of 1912 no fewer than 16 aeroplanes were in service with the Royal Navy; 13 of these were landplanes.



First deck-landing, August 2, 1917.

Soon after Gregory's pioneering take-off, however, the Royal Flying Corps was constituted by Royal Warrant. This was on May 13, 1912, and the new Service was created with both Military and Naval Wings. This arrangement was not looked upon with favour by the Admiralty, but it remained in existence until July 1, 1914, when the Royal Naval Air Service came officially into being as a separate branch of the Armed Forces.

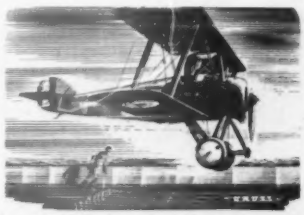
By this time the Navy had established a number of coastal seaplane stations. The first of these had been set up at the Isle of Grain, and by the summer of 1913 others had come into being at Calshot, Cromarty, Felixstowe and Great Yarmouth. Development of operating techniques was continuing and another important step was taken about this time when two seaplanes—one having folding wings—were operated from a launching platform on the light cruiser H.M.S. "Hermes." By the time war broke out in August, 1914, the newly formed Royal Naval Air Services had 78 aircraft—of which 40 were landplanes, 31 seaplanes and seven airships—and it had 130 officers and some 700 petty officers and ratings on the strength.

The R.N.A.S.'s contribution to the War effort was both gallant and considerable. It started right at the very beginning, when four aircraft of the Eastchurch Squadron at Dunkirk, under Cdr. Samson made, on September 22, 1914, the first British raid on German territory.

Because at the beginning of the War the R.F.C. was fully occupied overseas, the R.N.A.S. was given the responsibility for the air defence of Great Britain, and also the task of maintaining anti-submarine and anti-Zeppelin patrols over the sea. But this is not to say that our naval aviation was confined to Home duties; aircraft of the R.N.A.S. squadrons accomplished some remarkable bombing raids on such strategic targets as the Zeppelin sheds at Düsseldorf and Friedrichshafen. One must not forget, too, the great work done by the airships used for anti-submarine patrol, convoy escort duties and coastal reconnaissance. The Admiralty was, in fact, responsible for all airship operation until the end of 1919.

Although during the early part of the War the naval aircraft used were mainly land-based or were seaplanes and flying-boats operated from coastal stations, the development of the ship-based operation of aircraft continued—and was employed to a limited extent.

At the beginning of the War three cross-Channel steamers, "Empress," "Engadine" and "Riviera," were converted to seaplane carriers with sloping flying-off platforms on their forward decks. From these ships flew the seven aircraft which raided Cuxhaven on Christmas Day, 1914. A similar conversion, the Isle of Man steamer "Ben-My-Chree" had the distinction of launching the Short seaplane which, on August 12, 1915, in the Dardanelles, made the World's first successful attack from the air with a torpedo. The first successful torpedo drop from the air had been from a Short seaplane in July, 1914—the pilot being Lieut. A. M. Longmore (later to become Air Chief Marshal Sir Arthur Longmore).



Special deck-landing Camel on H.M.S. "Argus."

Later, faster ships fitted with platforms enabled landplanes to perform take-offs from them; the first of these was by a Bristol Scout on November 3, 1915, from H.M.S. "Vindex." It was not until August 2, 1917, however, that it proved possible for a landplane to alight on the deck of a ship. This was achieved by Sqn. Cdr. E. H. Dunning with a Sopwith Pup, who landed on a 228-ft. forward deck on H.M.S. "Furious." Soon afterwards Dunning was killed making another attempt and, as a result, the landing deck was moved aft of the superstructure; it was 284 ft. long and fitted with a crude form of arrester gear.

"Furious" claimed the distinction of being the only carrier in the 1914-18 War to have launched a major air action. This was on July 19, 1918, when seven Sopwith Camels took off from the carrier and attacked the Zeppelin base at Tondern.

It was not until October, 1918, that the Royal Navy's first carrier with a flush deck—H.M.S. "Argus," converted from the Italian liner "Conte Rosso"—began her trials. Meantime, however, other methods of launching aircraft from ships had

*These notes have been based largely on "British Naval Aircraft, 1912-58," by Owen Thetford; published by Putnam and Co., Ltd., 42 Great Russell Street, London, W.C.1.

been established. These included use of a short take-off platform mounted on top of a gun turret which enabled the aircraft to be turned into wind without the ship having to alter course.

The first take-off using this technique was in June, 1917, with a Sopwith Pup flown by Flt. Cdr. F. J. Rutland from the light cruiser H.M.S. "Yarmouth." A two-seater Sopwith 1½ Strutter was first successfully launched in this way from H.M.A.S. "Australia" on April 4, 1918. A lighter towed behind a ship was another successful platform from which aircraft could be launched at sea.

When, on April 1, 1918, the R.N.A.S. was merged with the R.F.C. to form the Royal Air Force, the naval service had no fewer than 2,949 aeroplanes and 103 airships. Its strength was 67,000 officers and men, and it operated 126 air stations at home and abroad. And by the end of the War 22 light cruisers had been equipped with flying-off platforms and all the Navy's battleships and battle cruisers carried a two-seater aircraft on their forward turret platforms and a single-seat fighter on their rear turret platform.

Avro Bison

With the coming of peace there was the inevitable recession in the Services and naval aviation shrank in 1919 to a mere single spotter-reconnaissance squadron, one fighter flight and half a torpedo squadron. By the beginning of 1924 there were 78 naval aircraft in 13 flights and by September, 1932, this number of aircraft had been doubled and the number of flights increased to 26. The following year the squadron was introduced as the basic carrier flying unit and the existing flights were merged into squadrons, except for some which continued as catapult aircraft. The number of aircraft continued to grow and there were 175 aircraft in 15 squadrons on the strength in May, 1935.

The years between the Wars were a most important formative period for the Fleet Air Arm as we know it today. Up to 1922 the Navy only had one fleet carrier in commission (H.M.S. "Argus"), but in that year came H.M.S. "Eagle"—the first of five new aircraft carriers. "Eagle" was followed by "Hermes" in 1923, "Glorious" and "Courageous" in 1928 and "Ark Royal" in 1938.

It is interesting to note that although some form of arrester gear was fitted to "Argus" and "Furious," this equipment was given up in 1926 and for the next five years aircraft were landed-on without arrester gear at all. In 1931, however, experiments were initiated on H.M.S. "Courageous" with transverse arrester wires; and this system, which was the forerunner of that used today, was fully developed by 1933; it made use of friction brake-drums and an electrical re-setting mechanism.

During this period of carrier development, too, came the introduction of catapult launching. The first such launching with a standard Fleet Air Arm aircraft was accomplished in the autumn of 1925, when a Fairey 111D flown by Wg. Cdr. Burling was catapulted from H.M.S. "Vindictive."

Parallel with these developments in equipment and technique, during the between-wars period there were changes also in the organization of the Service. In 1924 the R.A.F.'s carrier-borne branch, as it was then, was given the name of Fleet Air Arm. There was at this time continuous effort on the part of the Admiralty to regain control of its air section and in 1921 agreement had been obtained that naval officers should be trained as air observers. This was taken a step further in 1923, when it was recommended that all the observers in naval aircraft should be naval officers and that up to 70% of the pilots should be naval officers who should be given dual R.A.F. and R.N. rank.

It was not until 1937, however, that the Admiralty's efforts bore fruit and the Government announced that the Royal Navy would be given control of the Fleet Air Arm. This changeover was planned to be spread over a period of two years, by which time the Royal Navy would have complete control of its air arm, in which all personnel would be naval and for which the Admiralty would once again have its own shore air stations. The first naval air stations brought into being as a result of this were: Donibristle, Eastleigh, Evanton, Ford, Hatston, Lee-on-Solent St. Merryn and Worthy Down.

By the time War broke out in September, 1939, the new Fleet Air Arm was composed of 20 squadrons having 340 aircraft, 225 of which were carrier-based and the remainder were in catapult flights.

In the Second World War, as in the First, Great Britain's naval aviation played a considerable and important part. It would be invidious to pick out individual actions for mention in such a brief historical note as this; suffice to say here that the Royal Navy's aircraft were again operated extensively and with great gallantry.

It is, perhaps, interesting to record that at the beginning of the War, with one exception these aircraft types were all biplanes. The exception was the Skua dive bomber, and it was not until 1943 that all-metal monoplanes specially designed for the Royal Navy began to replace the biplanes in the first-line torpedo squadrons; these were the Barracudas. Seafires, however, had come into active operation with the Fleet Air Arm (which, incidentally, throughout the War years and until 1953 was officially referred to as the Air Branch of the Royal Navy, or more succinctly Naval Aviation) in 1942 with the carrier-borne squadrons. And the following year Lease-Lend American aircraft, such as the Corsair, the Hellcat and the Avenger, were delivered to the Royal Navy in substantial numbers.

So far as the ships were concerned, the principal development during the War was the introduction of Merchant Aircraft Carriers—converted cargo ships—to supplement the larger Fleet Carriers. By the summer of 1945 the Fleet Air Arm had 1,300 first-line aircraft with 10,000 used for second-line duties, for training, or in reserve. Its personnel strength amounted to 70,000 and it had six Fleet Carriers ("Implacable," "Indefatigable," "Indomitable," "Illustrious" "Formidable" and "Victorious"); and five Light Fleet Carriers ("Glory," "Ocean," "Theseus," "Triumph" and "Warrior").

Since the War the make-up and equipment of the Fleet Air Arm has changed considerably. In major part this has been due as much to the introduction of jet aircraft to replace the piston-engined types as to the changing policies and conditions.

The Royal Navy's first landing-on of a jet fighter was on December 4, 1945, when a modified Vampire was put down on to the deck of H.M.S. "Ocean." From that point, the Service was not slow in adopting the new prime-mover—for in August, 1951, the Fleet Air Arm's first operational Squadron of jet aircraft was equipped with Attackers; and by 1955 there were no longer any piston-engined types in service with naval first-line squadrons. Neither was the Royal Navy slow in making use of the special characteristics of turboprop engines, and Wyverns and Gannets with these power-plants went into service in 1953 and 1955 respectively. And again, the Fleet Air Arm showed its forward thinking by its ready adoption of rotary-wing craft for specialized duties; the first all-helicopter squadron was formed in 1950.

Supermarine Walrus

The immediate post-War period likewise saw major technical developments in British aircraft carriers. The most noteworthy of these was the invention of the angled flight deck to give greater deck area without increase in ship size. Complementary to this was the introduction of the steam catapult, for these two aids together enabled flying-off and landing-on to be made simultaneously. The third major aid to efficient carrier operation with modern jet aircraft has been the mirror landing sight, which has much simplified the final approach and touchdown and contributed greatly to safety.

This, then, brings us to the present day. This brief survey may at least have served to show that the modern Fleet Air Arm has behind it a long and noteworthy history and half-century of development, coupled with a splendid tradition of service. Later developments of the Fleet Air Arm's carrier force, its present organization, and the introduction of the new aircraft such as the Scimitar and Sea Vixen have been dealt with elsewhere in this issue to complete the story.

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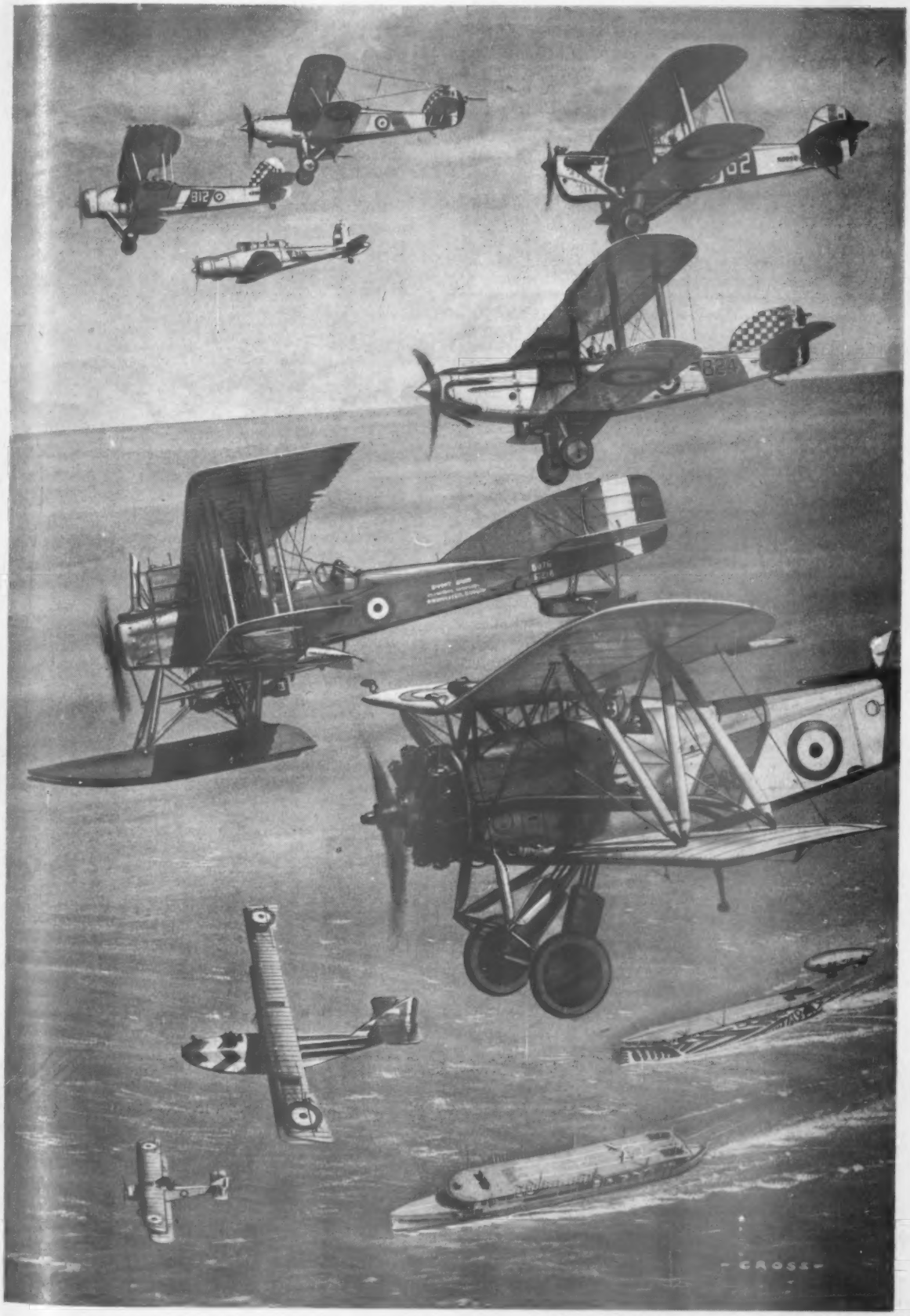


Drawings by Roy Cross, copyright "The Aeroplane."

F.A.A. TYPES.—In this composite picture are the Fairey Swordfish, Hawker Nimrod, Blackburn Skua, Blackburn Dart, Fairey IIIF, Short 184, Fairey Flycatcher, Felixstowe F.2A, H.M.S. "Argus," Sopwith 1½ Strutter and H.M.S. "Furious."

Firestreak on "Victorious"

New equipment, including Firestreaks, Scimitars and Whirlwind anti-submarine helicopters, in service on board H.M.S. "Victorious," the most up-to-date carrier in the Royal Navy, is described here by JOHN FRICKER, *following a recent visit to the Mediterranean.*

TO the Senior Service has gone the distinction of being the first to introduce the de Havilland Firestreak air-to-air missile into an operational unit, and Sea Venom all-weather fighters of No. 893 Squadron are now flying with these weapons from the deck of H.M.S. "Victorious" in the Mediterranean. As the most modern R.N. carrier, "Victorious" (Capt. C. P. Coke, D.S.O.) is also the first to have below-deck accommodation for the Firestreak, with special workshops, assembly points and test and laboratory facilities, and these are already being manned by specialist naval technicians who are participating in the initial working-up trials.

In many ways, it is appropriate that the Sea Venom should bring Firestreak into operational service, since the first air-launching of this missile was from a Venom all-weather fighter at Aberporth in 1955. On that occasion, the pilotless Firefly target was destroyed, and No. 893 Squadron's Venoms are due to start launching Firestreaks against similar aircraft in the near future from Malta.

Although the squadron, which is commanded by Lieut. Cdr. E. V. H. Manuel, is a fully operational all-weather fighter unit, Firestreak is not its primary weapon, and only a few of its aircraft are modified to carry this missile. Its Sea Venoms are being used to provide experience for the first Sea Vixen Squadron, which will dispense with cannon armament completely in favour of Firestreaks and multiple air-to-air rockets.

The missile-carrying Venoms on "Victorious" have had their four under-fuselage 20-mm. Hispano cannons removed and the space utilized for additional equipment for Firestreak launching, while a special control panel has been installed in the centre of the pilot's instrument presentation. A switch at the bottom left-hand corner of the panel energizes the missile from the aircraft's power supply, and a warning light is then extinguished when the Firestreak is warmed-up and armed.

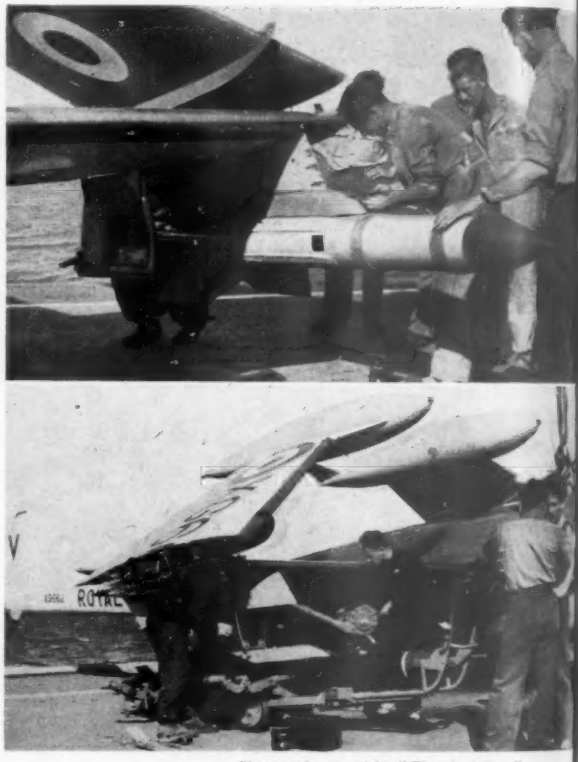
The heat-seeking eye in the nose of the missile then becomes active while the pilot continues the initial phase of the stern-chase interception by means of the normal AI. radar. After lock-on and range indication, the interception continues as before until the acquisition light shows that the missile infra-red homing system is locked on to the target, the destruction of which is then virtually assured.

Two Firestreaks are carried on underwing racks by the Sea Venoms, and either or both can be selected for firing by conventional switches. Initial phases of the trials by No. 893 Squadron have involved practice interceptions up to the acquisition stage, to gain experience of operating ranges and angles of approach, but firing cycles have been simulated, and no "hardware" has left the aircraft. At the same time, valuable information has been obtained on the effect on these missiles of catapulting and deck-landing; they are, of course, stressed for very high shock loadings.

Firestreak interceptions form a regular proportion of those practised by the Sea Venoms, which exercise at high and low altitudes, and at night as well as in bad weather, and complete their sorties with a CCA (carrier-controlled approach). "Victorious" has the most modern radar of any British carrier, by virtue of the planned delay in her refit, and has the latest pattern CCA equipment, in addition to the massive three-dimensional air defence radar which dominates the forward part of the island.

Hitherto CCA radar has been adapted from the AI. equipment carried in the Sea Venom, the ultimate versions of which are the FAW Mks. 21 and 22. No. 893 Squadron is the last FAA unit to operate Sea Venom 21s, which it first received in February, 1956. Since then, the Squadron has operated continuously with these aircraft, in conformation with the revised Admiralty policy against the disbanding of units after each commission at sea. Previously, first-line squadrons formed only for the duration of a carrier cruise, and disbanded on return, but this resulted in a lack of training and operational continuity. The new system also has the advantage of making more squadrons available for the ships, units remaining at shore bases between commissions, and the crews being relieved on their return.

No. 893 Squadron operated its Sea Venoms at Suez, and was then based for some time at Hal Far before returning to



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Acquisition and handling trials with the D.H. Firestreak are being completed by No. 893 Squadron with Sea Venoms on H.M.S. "Victorious" in the Mediterranean. Test and operational missiles are shown being loaded from the special handling trolley to the underwing racks of a Sea Venom 21.

In a characteristically nose-high attitude, a Scimitar of No. 803 Squadron is about to be catapulted from H.M.S. "Victorious," which has a unique and massive three-dimensional air defence radar on the "island."

Primary rôle of No. 824 Squadron's Whirlwind 7s is anti-submarine operations, for which they carry dunking Asdic or homing torpedoes. On the undercarriage legs are radar reflectors to facilitate position fixing.

Merryfield to change its aircraft in mid-1957 for modified FAW 21s equipped with Martin-Baker ejection seats for pilot and observer. As these become due for a major overhaul, they have been further modified to Sea Venom Mk. 22 standards, and in July this year, the Squadron received its three Firestreak-carrying aircraft, shortly before embarking on "Victorious."

In addition to Firestreaks, the "Victorious" has equally modern aircraft equipment among its complement in the massive form of the Supermarine Scimitar strike-fighters of No. 803 Squadron (Lt. Cdr. G. R. Higg). As the first operational Scimitar squadron, No. 803 was formed in June this year at Lossiemouth from the former 700X Flight trial unit, and completed an extensive familiarization programme in between appearing at the S.B.A.C. Show, before embarking in late September.

Despite its size and complexity, the Scimitar proved immediately popular with its pilots, who undertook armament training with the 30-mm. ADEN cannon, rockets and 1,000-lb. bombs in the working-up programme from Lossiemouth. The Scimitar is apparently particularly impressive in the low-level strike rôle, being immensely robust, but the Squadron also has a day-fighter interceptor task in which its transonic capabilities predominate. It is, in fact, the first transonic aircraft to enter FAA service, but its pilots find it as easy to fly as the Sea Hawks from which they have mostly converted.

The usual minor teething troubles of a new type were not assisted by the misfortunes which dogged the early period of No. 803 Squadron's formation, but none of the latter were attributable to the aircraft. A more recent snag, however, was encountered in "Victorious" in the Mediterranean, which has prevented the Scimitars from deck operations for the past several weeks and resulted in their temporary disembarkation to Hal Far, Malta. They were restricted from accelerated take-offs because of defects in the twin steam catapults of "Victorious" during assisted launchings.

Jet blast, in addition to noise, from the two 10,000-lb.+ Rolls-Royce Avons of the Scimitar has caused a number of difficulties in deck operation, and an important modification to "Victorious" before accepting this aircraft was the installation of two large steel deflector plates aft of the catapults. These deflectors can be erected hydraulically from their flush deck stowage to divert jet blast away from the island and flight deck, and are used whenever the Scimitars are being catapulted off.

Another complication in deck operation arises from the fact that as the controls of the Scimitar do not become effective to rotate it to its climb angle until a relatively high airspeed is achieved, the aircraft must be accelerated off at a large angle of incidence, with the nosewheel high in the air. This nose-high attitude apparently presents no problems to the pilot during catapulting, which is done with the assistance of flap blowing to obtain the maximum C_L at the minimum angle, and with wing leading-edges drooped. Flap blowing is also used for landing to improve lateral-control at a lower airspeed, and additionally results in a better view on the approach because of the flatter attitude.

Although "Victorious" is considerably smaller than "Ark Royal" or "Eagle," the Scimitars are able, under non-operational conditions, to make free take-offs from her fully angled deck, which at the moment is unique among Royal Navy carriers. The side-lift originally associated with this arrangement was removed before "Victorious" was commissioned, but fore and aft lifts give flexible access to and from the single hangar deck. The nose section of the Scimitar hinges through 180 degrees to bring down the fuselage within the lift dimensions, and may also be quickly removed for replacement by another cone containing cameras for tactical reconnaissance.

The Tac R noses are stored in the hangar alongside the Blackburn Palouste gas-turbine starters which are used by the Scimitars and the latter may be carried as underwing stores.

Apart from the usual AEW flight of No. 849 Squadron's Skyraiders, the only piston-engined aircraft on the "Victorious" are the Westland Whirlwind HAS Mk. 7 helicopters of No. 824 Squadron (Lt. Cdr. J. Trevis). This unit formerly operated Gannets, which have now been almost completely replaced throughout the Fleet Air Arm for anti-submarine duties by Whirlwind helicopters, and one squadron of these is to be embarked on each RN carrier.

Their standard equipment at the moment is the Leonides Major-engined Whirlwind 7, which, however, is regarded as an interim aircraft until the introduction of the Westland Wessex. The Whirlwind 7 has substantially greater power than previous versions of the S-55, but as its gross weight has also been increased, the overall performance is not greatly changed. For anti-submarine duties, a great deal of extra equipment is carried, notably in the form of dunking Asdic for detecting submarines under water, and in release gear for homing torpedoes, for attacking these targets.

As these are alternative loads for the Whirlwind, the helicopters usually patrol in pairs or greater numbers, as a "hunter-killer" team (these functions will be combined in the Wessex), each manned by a crew of pilot, observer and sonar operator. As future submarines powered by atomic reactors will hardly ever surface in the open sea, the Navy consider that sonar, which is helicopter-borne Asdic, is the only means of detecting them. Sonar patrols involve many hours of hovering or slow flying just above the surface of the sea, for which the Whirlwinds are being provided with automatic pilots.

Another very important task of the resident helicopter squadron on each carrier is the provision of "plane-guard" or search and rescue rotorcraft. At the moment, a helicopter fitted with a hydraulic winch and rescue sling is flown alongside the flight deck whenever take-offs or landings are in progress to pick up the crews of ditched aircraft, but with future gas-turbine rotorcraft requiring no warm-up period, "plane-guard" helicopters may be kept at immediate stand-by on a platform during carrier flying. The Whirlwind's hydraulic winch is fitted only for "plane-guard" duties, but a hand-operated hoist is permanently installed for emergency use.

While a "plane-guard" Whirlwind of No. 824 Sqn. flies alongside, two 893 Squadron Sea Venoms start up from their deck-edge park.

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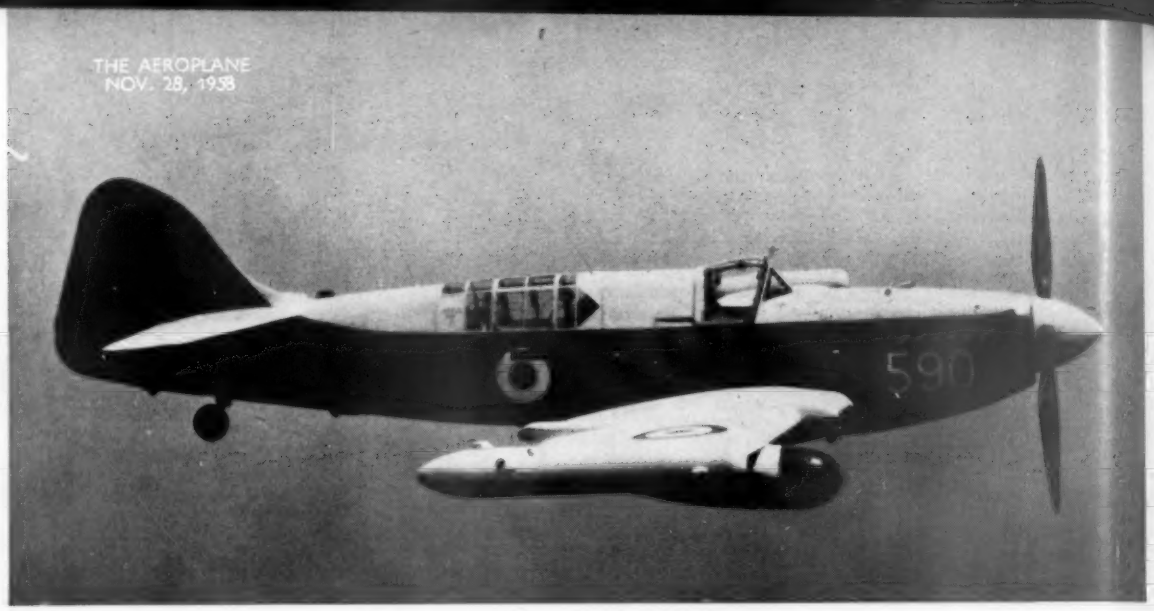

The Navy's Pilotless Aircraft

UNIQUE among Fleet Air Arm or R.A.F. squadrons is No. 728B Squadron, which operates from Hal Far, Malta, and is the only Service unit equipped with radio-controlled pilotless aircraft. The formation of No. 728B Squadron was antedated by another pilotless aircraft unit at Llanbedr, not far from the guided-weapons test station at Aberporth, on the Welsh coast, but although manned partially by Service personnel, this in fact is a Ministry of Supply organization.

The functions of both units are concerned with the development of guided missiles, but No. 728 Squadron is more specifically connected with the first naval weapons of this type. Its primary task is to provide targets for the Navy's first surface-to-air weapons ship, H.M.S. "Girdle Ness," which at present is engaged on launching trials with the Armstrong Whitworth Seaslug in the Mediterranean. At a later date No. 728 Squadron will also co-operate with the first firings of Firestreak by naval aircraft in the Mediterranean.

Commanded by Lieut. Cdr. John Corbett, R.N., the Squadron was formed at R.N.A.S. Stretton in January of this year, and was equipped with Fairey Firefly U.9s, which are radio-controlled versions of the former Firefly 5s. Prior to the formation of the Squadron, pilots and ratings had visited Llanbedr, to observe the operation of the M.o.S. Firefly U.8s (ex Firefly 7s), and study the ground-control equipment, but had not practised any radio-controlled flights.

The first of these was not performed until after the Squadron's Fireflies had been flown out to Malta, in February and several months' training had subsequently been completed. Although it is not possible to describe the control equipment of the Firefly in detail, it may be mentioned that as radio

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Developing the Firefly Drone

THE Fairey Firefly was selected as the first British aircraft to be converted as a radio-controlled target drone, and six Firefly T.7s were made available by the Ministry of Supply for this purpose early in 1952. For pilotless operation the aircraft were fitted with a Mk. 9 autopilot, modified for remote control; radio control equipment; two-position electric actuators for undercarriage, flaps, ignition switches, deck hook and airscrew pitch; throttle control unit; an emergency dive system to destroy the aircraft; and weapon-assessing gear.

Provision was also made for manual flight with accommodation for a pilot and an observer. Remote control was by means of a series of radio signals, which when selected, were translated to predetermined flight conditions by operation of the appropriate airframe and engine-control systems.

Overall flight control was through the autopilot. If, for example, a starboard turn was required, a signal would be fed to the right-turn relay and the autopilot would initiate the appropriate rudder control. If no signal was received for a predetermined period, the aircraft was designed to go automatically into an orbit, and in the event of total loss of control, a separate receiver was included to operate crash-dive equipment to destroy the aircraft.

With this equipment, development of the six Firefly drones was continued at White Waltham in conjunction with R.A.E., Farnborough, and following the achievement of successful results a contract was placed for the production of a further 34 Firefly T.7s. Because of the urgency of the drone requirement, the conversion arrangements in the initial six aircraft for pilotless operation were not the most suitable from an operating point of view, and production aircraft were revised to incorporate a better equipment layout within the limitations of the basic design.

A pure conversion programme from existing aircraft was therefore not embarked on, and instead components and details surplus to the requirements of the original Firefly T.7 contract were used to produce an improved layout of equipment and controls. The first production Firefly U.8 as the Griffon 59-powered drone was designated, first flew at Ringway on November 27, 1953, and the type then went into M.o.S. service at Llanbedr.

The prototype and early production aircraft were fitted with 11-in. diameter camera nacelles on each wing tip as part of the weapon-assessing gear. These cameras were electrically actuated and designed to photograph "near misses" of intercepting missiles. With the introduction of a larger and improved camera, however, a new nacelle of 16-in. diameter was introduced, and was interchangeable with the smaller type. The larger nacelle also accommodated, in alternative rear fairings, homing devices for new missiles then under development.

A further contract was subsequently placed by the Ministry of Supply for a further 40 Firefly drones, but these were specified as conversions of obsolete Firefly Mk. 5s. Although involving considerable redesign of components used in the Firefly U.8, the modified Mk. 5s, known as U.9s, were also able to have incorporated in the observer's cockpit a much improved layout of equipment. The first "production" Mk. 9 flew at Ringway on December 13, 1956, and the type now equips No. 728B Squadron.

(*Continued from page* 800)

command is exercised throughout pilotless missions from the ground, the aircraft is inevitably out of sight from its controllers for most of the time, which involves particular difficulties. In addition to continual radar surveillance, watch is also maintained on the pilotless "drones" by accompanying "shepherd" Fireflies, whose pilots relay information back to ground control by R/T.

The "drones" are programmed to fly pre-computed flight patterns, the sequence of which can only be varied so far as the time factor is concerned, via the autopilot and airspeed control. This equipment converts the demands from ground control into variations of attitude, manœuvre, height, speed, etc., in addition to maintaining the normal flight stability of the aircraft. Another vital component of the Control and Engagement system is the telemetry, which provides the necessary flight information such as airspeed, rate of climb, altitude and engine speed, for the ground controller to fly the aircraft.

The squadron pilots have the additional job of performing test and proving flights in the Fireflies, under ground control, after a particular set of parameters has been set up. On these flights the pilots are on board only as monitors, control being exercised from the ground from take-off to landing, and initial experience with this task is described by the aircrew of No. 728B Squadron as "slightly spine-chilling."

Getting the Fireflies off and on the ground is the responsibility of two controllers, who are also drawn from among the squadron pilots. The azimuth controller stands at one end of the runway, and keeps the aircraft aligned on it by means of two buttons, for right and left rudder actuation, while the pitch controller has his box of tricks to one side of the runway and selects the appropriate regime to govern the height of the aircraft. One of the main requirements of the controllers is to anticipate any large variation of attitude on the part of the radio-controlled aircraft, since unlike the faculty possessed by the human pilot, the servo controls have a non-variable rate of application.

Despite the limitations of the Firefly—which has a considerable torque reaction from its piston powerplant, and a tail-wheel undercarriage, thereby complicating both take-off and landing under radio control—the squadron attained reasonable success on their first pilotless flights, from July 8 onward. Some difficulty, however, was experienced with landing the aircraft after their sorties to 15,000 ft. or so, mainly because of inadequate control at low speeds. Another snag was that the Firefly had been designed for a piloted three-point landing, and when the pilotless aircraft were brought in for a "wheeler" touch-down at a higher speed and in a level attitude, the underfuselage hook was not long enough to engage the runway arrester wires.

These are rigged across the into-wind runway and secured to long lengths of anchor chain, which effectively decelerate the Fireflies in a very short space, and also limit bounces to acceptable magnitudes. To ensure their engagement, the squadron has extended the arrester hook by a considerable amount simply by adding a Sea Hawk "sting" hook to the original retractable "V" frame of the Firefly. The first hook was taken from a Sea Hawk which had been ditched and, with slight modification to the airframe, effectively solved the problem.

Quite often, of course, the landing problem does not arise, since the Firefly may have been destroyed by a direct hit, although in most tests the guided weapons are fitted with telemetry equipment rather than explosive warheads. To assess the qualities of the missile interception path, the Fireflies carry a proximity optical recorder system comprising two wing-tip pods, each containing five 35-mm. movie cameras, which are remotely controlled via a radio link and camera control unit.

The Fireflies have proved quite suitable as missile targets at medium and low altitudes, their relatively low speed being compensated for in the latter case by a further reduction in height, resulting in high tracking speeds. With underwing fuel tanks, their sortie time may be four hours or more, which is a useful feature in the delicate business of setting up several missile test launches. No concessions to short life have been made in the red-and-cream Firefly "drones," but these aircraft were due in any case to be scrapped, so that their useful life has been substantially extended for the cost of the radio control equipment and other modifications. Although having operated for only a few months, No. 728B Squadron has already achieved four pilotless sorties with one of its Fireflies, and these are appropriately recorded by an equivalent number of missile symbols beneath the cockpit.

Future commitments will include the provision of pilotless targets for the Firestreak air-to-air missiles fired from the Sea Venoms of No. 893 Squadron, and, at a later date, conversion to Meteor U.15s or 16s for high-speed high-altitude targets. The lack of torque reaction and the nosewheel undercarriage of the Meteor should simplify take-off and recovery, but no doubt pilotless jet operation will provide other problems. To the naval pilots of No. 728B Squadron, however, flying their red-and-cream aircraft from the ground or in the air will remain one of the most fascinating jobs in military aviation.—J.E.F.

Above, under remote control from the ground, the undercarriage and arrester hook of this pilotless Firefly U.Mk.9 of No. 728B Squadron are extended for landing at Hal Far. Airscrew pitch is also changed on the approach (right) and flap lowered as the Firefly "drone" is brought in to engage arrester wires on the runway. The original arrester hook shown here has since been extended by the squadron to ensure engagement during a tail-up landing.

Naval Aviation Down Under

AUSTRALIAN naval aviation dates officially from early 1948, when an air arm of the R.A.N. was established. The original aircrew were recruited initially from ex-R.A.A.F. wartime officers and a few pilots who flew with the Royal Navy during the Second World War. These officers formed the squadrons for the R.A.N. Air Station at Nowra and for H.M.A.S. "Sydney" which was commissioned in September, 1948. A second carrier, H.M.A.S. "Melbourne," was also planned. The training of the Fleet Air Arm ratings was introduced at R.A.N.A.S. Nowra, which was commissioned as H.M.A.S. "Albatross."

The first aircraft were disembarked from H.M.A.S. "Sydney" to R.A.N. Air Station Nowra in mid-1949. These were the Fairey Firefly anti-submarine aircraft and Hawker Sea Fury fighter-bombers of Nos. 816 and 805 Squadrons which formed the 20th Carrier Air Group.

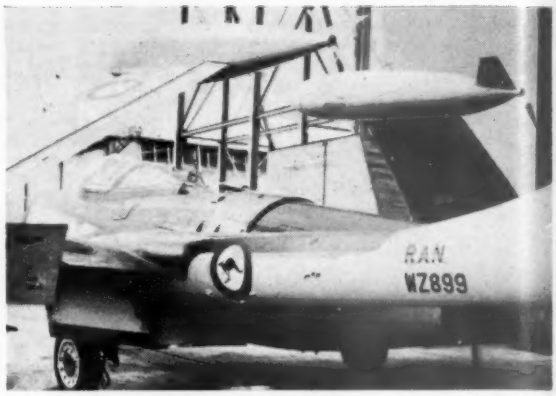
This had been formed in August, 1947, at R.N.A.S. Eglinton, in Northern Ireland, from where it had worked up to an advanced standard of operational flying before embarking on the initial cruise of H.M.A.S. "Sydney." On her second cruise, in November, 1950, "Sydney" collected a second air group of Sea Furies and Fireflies, in Nos. 808 and 817 Squadrons of the 21st C.A.G.

Normal training continued until Australian assistance was proffered to the U.N. forces in the Korean conflict. H.M.A.S. "Sydney" then sailed for Korea in October, 1951, with a composite group of Fireflies and Sea Furies from Nos. 805, 808 and 817 Squadrons for a four-month period as part of an Allied task force. The R.A.N. aircraft flew an intensive tour of missions on close-support and escort duties, attacking a variety of ground targets with bombs, cannon and rockets.

A second, six-month tour of operations in Korea was started towards the end of 1953 by Nos. 805, 816 and 850 Squadrons of the R.A.N., but this was interrupted by the Armistice, and the Sea Furies and Fireflies remained for some time on stand-by.

In the same year, "Sydney" was augmented by a second carrier, the "Vengeance," on loan from the Royal Navy, as the "Melbourne" had been delayed to incorporate a number of new developments to improve deck operations. At about the same time, another R.A.N. shore establishment was opened near Sydney, and was commissioned as H.M.A.S. "Nirimba." Aircraft re-equipment was then becoming a matter of necessity, but the only notable additions to R.A.N. strength had been several Bristol Sycamore HR.50 and 51 helicopters, which had arrived during the previous year for "plane-guard" and search and rescue duties.

By the middle of 1954, however, the five first-line squadrons of Sea Furies and Fireflies had been joined by the first Vampire trainers, which were built by de Havillands in Australia, and these went into service with a second-line unit, No. 724 Squadron, to build up a nucleus of naval pilots with jet experience. This was in preparation for a large-scale re-equipment programme for which a number of Sea Venom FAW.53 all-weather fighters and Gannet AS.1 anti-submarine aircraft had been ordered.



A Sea Venom FAW.53 of the R.A.N. at the de Havilland factory at Bankstown.

Three squadrons—Nos. 808 (Sea Venoms) and 816 and 817 (Gannets)—were formed with the new aircraft at Royal Naval Air Stations in the U.K. and spent several months working up alongside F.A.A. units before embarking on H.M.A.S. "Melbourne." This ship had finally been completed to the latest operational standard, with a half-angled deck, steam catapult and deck-landing mirror sight, and, with her new aircraft, arrived in Australia in May, 1956. After a few months ashore at Nowra, the re-equipped squadrons went to sea in "Melbourne" again in August, 1956, to take part in large-scale SEATO exercises.

"Vengeance" was returned to the Royal Navy early in 1955 and "Sydney" has since been placed in reserve, leaving the R.A.N. with one operational carrier.

Since 1956 H.M.A.S. "Melbourne," with the front-line squadrons and other units of the Australian Fleet, has continued to participate in exercises in SEATO waters.

Second-line squadrons at R.A.N. Air Station, Nowra, are engaged in the tasks of all-weather fighter training in Sea Venoms, helicopter training in Sycamores, and the provision of fleet requirements aircraft, for which Gannets and Firefly 5 target tugs are used.

The operational flying training of pilots and all observer training was carried out at R.A.N. Air Station, Nowra, from 1955 until December, 1957, when aircrew were again sent to the United Kingdom. After initial training at Flinders naval depot R.A.N. pilots train to "wings" standard with the R.A.A.F., while observers proceed directly overseas.

Canada's Naval Air Arm

THIS SUMMER visitors to the Royal Canadian Navy's displays at the Canadian National Exhibition in Toronto were told that an enemy submarine could even then surface off the Atlantic coast and fire guided missiles at Toronto and other cities hundreds of miles inland. The post-War development of long-range, high-speed submarines has added greatly to the Navy's difficult task, and the size of the Russian 500-unit submarine fleet is an ever-present warning of the need to be prepared.

Aircraft have an important part in the R.C.N.'s rôle as a specialized anti-submarine force. The main weapon in the air armoury is the Grumman CS2F-1 Tracker. One hundred of these twin-engined aircraft have been ordered from de Havilland of Canada at Downsview, near Toronto, and about 47 have been delivered. Modifications or lack of equipment have held up delivery of about half as many again, but the programme should soon build up to the delivery of six aircraft a month.

Two of the Navy's five front-line squadrons, VS880 and VS881, are equipped with Trackers, and one squadron is usually embarked on the light fleet aircraft carrier "Bonaventure." The Tracker is now settling down into squadron service and has become well liked for its ease of handling and good visibility. Bendix PB.20 automatic pilots, soon to be fitted, will enable pilots to preselect cruising altitude and have the autopilot fly the aircraft during catapult take-offs. This feature is particularly appealing for night operations. An ILS lock is fitted for instrument approaches, but as yet this has no application to carrier landings. Decca is another item which may be fitted.

Unlike its predecessor, the Guardian, the Tracker combines the search and strike functions. The CS2F-1 can carry homing torpedoes, depth charges, rockets, sonobuoys, a magnetometer, a searchlight and electronic countermeasures (ECM) gear. The last-named is used for long-range detection rather than jamming, as the name suggests. All these black boxes require a crew of four: a pilot, co-pilot, radar/sonobuoy operator and magnetic-anomaly/countermeasures operator. The last two crew members are ratings who are interchangeable, having been trained for both jobs. This assignment of duties has made the

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observer, a key-man in the three-place Avenger, redundant, and this trade has all but disappeared.

Concurrently with experiments in Britain, the R.C.N. has fitted helicopters with "dunking Asdic." Extensive and successful trials in the Atlantic and Caribbean have resulted in a decision to fit hangars to some St. Laurent-class destroyer-escorts. Each ship will carry a Sikorsky HO4S-3 of Squadron HS-50. These aircraft mount a single homing torpedo, pointing downward at about 45°, on a rack on their port side. Huge fluorescent red letters are painted on the sides and noses of the helicopters so that an escort vessel, on receiving a radio report of a sonar contact, can speedily head for the right machine.

The remaining operation squadrons, VF 870 and VF 871, are equipped with McDonnell F2H-3 Banshees. This autumn they were fitted with Sidewinder infra-red homing missiles, thus making the Navy the first Canadian service to introduce operational missiles. This innovation has helped to delay the Banshees' retirement, although the pilots are eager for transonic and supersonic experience. The Banshees were purchased second-hand from the U.S. Navy and have not enjoyed the acceptance of their predecessors, the Sea Furies and Seafires.

One of the Banshee squadrons is usually embarked with a Tracker squadron and a few helicopters on H.M.C.S. "Bonaventure." This 20,000-ton ship was built in Belfast and commissioned in early 1957. She has those great inventions, the steam catapult, angled deck and mirror landing aid. The last two items, incidentally, make it difficult for Avengers to land on, since the view over the nose of a TBM is so poor that a straight-in approach is not desirable.

Squadrons not embarked on "Bonaventure" operate from the lone naval air station H.M.C.S. "Shearwater," at Dartmouth, N.S. Experimental Squadron VX10, Helicopter Squadron VH-21, Utility Squadron VU-32 and a training squadron are all based there. Apart from the duties suggested by their names, they are responsible for communications, "plane-guard" duties and training observers' mates. Equipment used includes Beechcraft Expeditor 3s, North American Harvard 2s, Lockheed T-33 Silver Stars and a few Bell HTL and Piasecki HUP helicopters.

Like the other Canadian services, the R.C.N. has maintained close liaison with its American counterpart. For several years cadets from the naval college H.M.C.S. "Royal Roads" at Esquimalt, B.C., have received flying training (up to wings standard) at the U.S. Naval Air Station at Pensacola, Florida. The infusion of American ideas and methods is furthered by the regular joint exercises under COMLANT.

Liaison is not confined to the Americans, of course and, as this is written, the two Banshee squadrons are exercising with the Army and R.C.A.F. a thousand miles inland at the Canadian Joint Air Training Centre at Rivers, Man.

Supplementing the regular force are five reserve air squadrons equipped mainly with Harvards. They are VC-920 at Downsview, Toronto, VC-921 at Kingston (Ont.), VC-922 at Patricia Bay, B.C., the airport of Victoria, VC-923 at Quebec City and, far from the sea, VC-924 at Calgary (Alta.). As the supply of

Built by de Havilland Canada, the CS2F-1 Tracker equips two R.C.N. anti-submarine squadrons, one of which is operating from H.M.C.S. "Bonaventure."

War-time pilots has dried up—such are considered too old—most of the squadrons are taking men with private pilots' licences and training them to wings standard. This process is whimsically referred to as *ab initio* training. Immigrants who have recently been in the R.A.F. Auxiliary or the R.N. Air Reserve are considered better material.

The Toronto Squadron, commanded by Lieut.-Cdr. George Ballard, has an Expeditor 3NM, two Harvard 2s and four Avenger A.S.3Ms. The last is a Canadian variant with retractable magnetic airborne detection and E.C.M. gear. This equipment and the radar are readily used for ship tracking, as the much-travelled Great Lakes are on the Squadron's doorstep. Pilots get in about 12 hours a month, including a monthly rocket-firing and depth-bombing practice at the R.C.A.F. range at Trenton, Ont. The only other reserve unit to have operational aircraft is VC-922 at Pat Bay, which borrows the Avengers of the local utility squadron, VU-33. The latter is the only regular force air unit not stationed at Dartmouth or on the carrier.

Ultimately, perhaps next summer, all the reserve squadrons will get Trackers. The few remaining but much-loved Avengers, or Turkeys as they are called, will then be sold. Several ex-R.C.N. TBMs were used with some success last summer to spray Maritime forests against the budworm.

Cdr. James A. Fotheringham, the director of naval aviation, has at his disposal 350 officers and 1,700 men, apart from reserve-force personnel. There are just under 150 operational aircraft. This is not a large force, but N.A.T.O. exercises like "Mainbrace" have shown it to be an effective one, able to operate on equal terms with its neighbours and partners.—N.A.M.

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Having originally been equipped with four 20 mm. cannon the McDonnell F2H-3 Banshee all-weather single-seat fighters of Squadrons VF 870 and VF 871 of the R.C.N. were recently equipped to launch Sidewinder infra-red homing missiles.

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Lancashire Aero Club Oldtimers

THE FIFTH annual dinner of the Woodford Old Associates took place at the Macclesfield Arms Hotel on November 14 in a wonderfully happy atmosphere which always pervades this gathering of original flying members of the Lancashire Aero Club—those who knew Woodford as a grass field with a pond in the middle, before it became the gigantic Avro aerodrome with its miles of concrete runway.

In proposing the toast of the Woodford Old Associates BILL ARMITAGE, the present chairman of the Lancashire Aero Club, was pleased to tell us that the Club had made a profit. This drew a reminiscent story from W.O.A. chairman JOE SCHOLES that in the old days of the late 'twenties the Lancashire Aero Club seldom made a profit, not, at least until they were approached by the Blackpool Corporation to run their Air Pageant. In that year the Club made a profit of £3,000. This venture cost the Blackpool Corporation £16,000 but they no doubt gained vast publicity and brought much trade to the town.

He added in his speech that all were very proud that the W.O.A. president, SIR ROY DOBSON, had become the head of the Hawker Siddeley Group. "Dobbie" replied in his turn with a typically informal and witty speech. He was followed by JOHNNY CANTRILL and ROWLAND HALL in similar vein.

ALAN GOODFELLOW was elected chairman for 1959.

F.A.A. Officers' Association Ball

NEARLY 400 guests, most of them connected with naval aviation past and present, spent an enjoyable evening of dancing and reminiscing at Londonderry House on November 14. The occasion was the annual ball of the Fleet Air Arm Officers' Association.

During the evening it was announced that Admiral Sir John Eccles had honoured the Association by agreeing to become its first president. Sir John retired from the Navy this year; his final naval appointment was C.-in-C. Home Fleet.

Other highlights of the evening included the drawing for more than £100 of prizes by Mrs. Evans who attended the ball with her husband, Rear-Admiral C. L. G. Evans (Deputy Chief of Naval Personnel), and an unofficial announcement that membership of the Association had reached 300.

Guests included Admiral Sir Alan and Lady Scott-Moncrieff, Cdr. and Mrs. R. A. Allen, Parliamentary and Financial Secretary to the Admiralty, Capt. Mike Fell, Capt. David Kirk, Deputy D.O.A.T., and Capt. Nigel Bailey, Assistant D.A.W.

Prizes for Perspicacity

IN the Air Council Room on November 13, Air Marshal Sir Geoffrey Tuttle, the D.C.A.S., presented this year's L. G. Groves Memorial Prizes.

Flt. Sgt. F. G. Johns, electrical fitter, No. 5 F.T.S. Oakington, received the Air Safety Award, cash and prizes to the value of £37 10s., for his "Jet Clock," now used through Flying Training Command. It stores essential information of aircraft airborne times relative to fuel states, etc., and gives audible and visual warning to air traffic controllers at the end of any given period within one hour. The device is being miniaturized and installed at operational stations.

The award for air meteorological observers went to Flt. Lt. R. E. Parsons, A.F.C. As air met. observer leader at Christmas Island he flew 215 hr. on met. recce. and was responsible for the preparation and dissemination of met. information and the instruction of other observers.

The prize for meteorology was presented to Mr. R. J. Murgatroyd, a meteorologist since 1939. During his seven years' leadership of the Met. Research Flight, Farnborough, he and his collaborators have made many important contributions to research, especially in cloud physics. He also studies the high atmosphere and received a degree of Doctor of Philosophy in the University of London for his paper, published in the "Journal of the Royal Meteorological Society," on the subject of "Winds and Temperatures between 20 km. and 100 km."—WREN.

Twenty-five this Week

THIS WEEK, the Graviner Manufacturing Co., Ltd., celebrates a quarter of a century of service to the aircraft industry as a specialist in airborne fire-suppression equipment. Although not large by most industrial standards, the Graviner company nevertheless produces a wide range of equipment and is justly proud of the fact that it is used on all the new major British civil and military aeroplanes. In 1954, when the company came of age, we commented (THE AEROPLANE for December 31, 1954) that it was devoted to the applied science of fire protection and that it had played no small part in the developments in that particular field. This remains true today for its contribution in this important sphere continues unceasingly.

Graviner—the name comes from GRAVity INERtia switches, the original products for which the company was founded to make—was brought into being by Mr. A. Mathisen, F.C.I.P.A., A.F.R.Ae.S. A year after it was formed he tendered a design of automatic fire-extinguishing system to meet an Air Ministry specification. His system was in fact adopted by the Ministry and after receiving a small initial development contract order, the Graviner company received, in 1938, a production order for 1,000 sets.

Meantime, however, financial problems in the new company necessitated some outside help being found if production was to be undertaken. This aid was forthcoming from the Wilkinson Sword company at Acton and there came into being the close ties between the names of Graviner and Wilkinson that have lasted to the present day.

In 1939 the company received an official directive that it should obtain some additional accommodation in order to avoid concentration in one place of the production of such important equipment. As a result, towards the end of that year, Graviner's present home at Poyle Mill, Colnbrook, was acquired. And the following year the greatly increased wartime demands on output led to the acquisition of the Fleetlands Foundry at Gosport.

During the War years, and since, the Graviner company has spent a sizeable proportion of its effort and resources on research and development. From this has come a useful range of high-rate discharge methyl-bromide extinguishers and unit fire detectors; Crashtrip strip-type contact switches; inertia crash switches; explosion suppression equipment; and Firewire heat-detecting "wire."

As one would expect with such an energetic and enthusiastic team, this process of development and expansion is continuous and much has happened even in the four years since Graviner celebrated its 21st birthday in 1954. For example, the works block at Colnbrook has been extended in floor area by some 50% to accommodate the ever-growing production demand for Firewire and explosion protection equipment; the personnel strength, too, has increased and at Colnbrook now stands at about 500 in comparison with about 350 in 1954.

This growth, however, has not been confined entirely to domestic affairs and Graviner's wider interests in the World markets have also been extended. In 1957, the company signed an agreement with Fenwal Inc. of Massachussetts which covered a cross licensing of patents and an exchange of technical and manufacturing information in their respective products. On the Continent, Graviner Products MijNV of The Hague was formed in 1953 to act as a servicing and sales organization on the other side of the Channel. And at the present time negotiations are in progress for the formation of a small daughter company in Germany.

Recent technical developments in Graviner equipment have included the introduction of a new technique for making Firewire in which the element is now produced by a continuous process rather than by individual pieces, giving important advantages in strength. The Firewire system is, incidentally, now fully approved by the American C.A.A. and will be installed on such aircraft as the Conway-powered Boeing 707s, the Grumman Gulfstream and the Eland-powered Canadair Type 540.

Control units are being developed to operate on DC giving lighter equipment and more flexible operation. Various new extinguishers have been added to the range employing such fluids as bromotrifluoromethane and dibromodifluoromethane. Explosion protection equipment is in full-scale production and is used on the latest British Service aircraft.

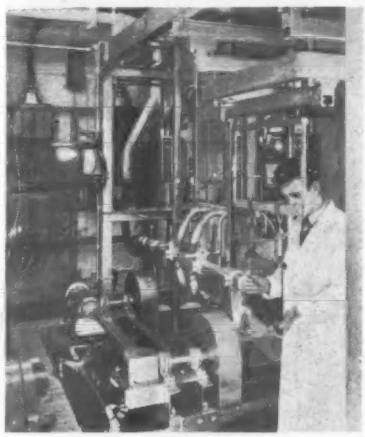
All in all, as a highly specialized component of the British aircraft industry—to say nothing of other industries making use of its products—the Graviner team enjoys a special place and an enviable reputation. And having completed its first quarter of a century it can look forward to the next with every prospect of continued success.—F.T.M.

News of Industry

Fundamental Research on Glass

THE WORK of the Triplex Fundamental Research Laboratory at Holly Grange, Balsall Common, near Coventry, was demonstrated recently. This laboratory was formed a year ago for fundamental studies in the science of glass and of the processes used in the production of laminated and toughened safety glass.

The departments of this research centre include a series of laboratories covering X-ray diffraction, electron-microscopy, thermodynamics, mechanical properties, heat treatment, optics and chemistry.



This high-temperature toughening furnace is used for the experimental production of toughened glass at the Triplex Fundamental Research Laboratory.

There is also a small technical library and an equipment and instrument room in which much of the research centre's special equipment has been built.

Toughened glass is produced by heating a glass sheet to its softening point and then cooling its outer surfaces by air jets. The outer surfaces cool more quickly than the centre and thus a differential stress system is set up, with the outer layers in compression and the centre of the sheet in tension. This heat-treatment process is being studied by the research centre; results will be used to make improvements in the safety glass for motor vehicles and aircraft.

Studies are being made of the effect of kinetic heating on glass for aircraft. Very high speeds impose a limit on the use of glass; for future high-speed aircraft, fused-quartz transparencies will be necessary, as this material has better thermal properties than conventional glass. Triplex is engaged on work in this field.

Storey Uniflote Rafts

THE USE of Uniflote rafts as landing platforms for helicopters was demonstrated on November 12 when Roy Bradley, a Westland test pilot, made several landings and take-offs with a Whirlwind from a Uniflote raft floating on the Thames at Chiswick (right).

Uniflote rafts are produced by Thos. Storey (Engineers), Ltd., of Stockport and London, the company which is the World licensee for the manufacture and sale of Bailey bridging. Its Uniflote floating platforms are based on a system of construction from standard units which is similar to that used for Bailey bridges. Standard Uniflote pontoons can be joined in a variety of ways to form floating platforms, bridge pontoons, rafts and ferries.

The basic Uniflote is a steel pontoon 17 ft. 4 in. long, 8 ft. wide and 4 ft. deep, which weighs about 3 tons and has a displacement of 3 in./ton. Couplers at the sides and ends of each Uniflote allow units to be connected side-to-side, end-to-end and side-to-end to form platforms of any desired shape or size.

When used as ferries Uniflote platforms can be powered by 35, 60 or 130-h.p. Harbormaster outboard motors. The Uniflote raft on which the helicopter alighted during the demonstration was powered by four of these power units. No Uniflote rafts are yet in service as landing platforms for helicopters, but a company engaged on oil-drilling in the Persian Gulf has shown interest in them.

Under the Microscope

THE new Ferodo Research Laboratories at Chapel-en-le-Frith, Derbyshire, were officially opened by H.R.H. the Duke of Edinburgh on November 21. They will perform many important functions for science and industry. Nowhere else in the World, it is claimed, is so much scientific effort directed to the study of friction phenomena and the development of friction materials. This establishment now concentrates in one building the company's chemical and physics laboratories, the test house, the test garage, workshops, a drawing office and experimental production laboratory, also a library and administrative quarters.

Ferodo production, amounting to a million items per week, ranges all the way from disc brake pads to sintered metal clutch facings for earth-moving units.

Apart from studying the product and its constituents, many other spheres are explored. Although knowledge of the physical and chemical processes which take place within materials is considerable, the study of the surfaces of solids has been relatively limited. More is known about the particles and forces involved in the atom, about the atomic arrangement of the molecule and about the molecular arrangement forming the solid, than is known about the effects arising on the boundary of the solid. A group of Ferodo physicists is therefore studying the nature of surface friction as an abstract problem.

Another team has been examining properties of asbestos, one of the principal raw materials for the manufacture of the conventional brake-lining. They have established among other things, that the fibres of chrysotile asbestos, as used in friction materials, consist of tubes of cylindrical layers of atoms stacked one inside the other. Other groups are engaged in applied research dealing with such matters as the development of new resins and braking problems.

On the southern side of the laboratory building is the test house in which more than 20 electronically controlled machines run day and night. The experimental production laboratory, where detail checks are made, lies on the north side of the research establishment.

Throughout the Ferodo Research Laboratories every aspect of the power-to-stop problem is under constant consideration, for the practical use of many new devices is dependent on the parallel development of suitable forms of control.

American Approval

THE Saunders Valve Co., Ltd., has announced the approval of its Mk. 4 S.P. aero valves by the American Naval Authority. After prolonged testing of two groups of valves up to 2-in. diameter at the Aeronautical Engineering Laboratory, Navy Yard, Philadelphia, these components have been recommended for use on U.S. Naval aircraft. As the tests are based on Specification MIL.5018A this recommendation means that the valves can also be used on military and civil aircraft in both the U.S.A. and Canada.

Saunders Mk. 4 range of S.P. aero valves is now being manufactured and supplied in this country, and among aircraft at present fitted with this type are the Vickers Vanguard, the Armstrong Whitworth A.W.650 and the Handley Page Herald. The 1¼-in.-diameter prototype valve now undergoing a life endurance test has exceeded 1,800,000 cycles of operation and is still in good condition. Motor units and spindle seals can be changed without removing the valve from the pipeline or defuelling the aircraft.

Photograph copyright "The Aeroplane"

Private Flying

H.J.C.'s CLUB COMMENTARY

● IN OUR issue of July 25 we referred briefly to the Crusader two-seat all-metal light aircraft which is being built by Condesco, Ltd., at Enfield. This design has a twin-boom layout, side-by-side seating, and a 65-h.p. Porsche 678/0 flat-four engine driving a 5 ft. 6 in. propeller. A 90-h.p. engine is a possible alternative and there is tankage for 15 gal. of fuel. The nose-wheel undercarriage is steerable and fitted with brakes.

The estimated performance is, maximum speed, 107.5 m.p.h.; cruising speed, 96 m.p.h.; stalling speed, 38 m.p.h.; endurance, 4 hr.; range, 395 miles; take-off to 50 ft., 261 yd.

Span, 24 ft.; length, 20 ft. 6 in.; wing chord, 5 ft.

CAMBRIDGE GROUP.—Two former A.T.A. pilots, Mrs. Anne Duncan (left) and Mrs. Veronica Volkertz, are taking instructors' courses with Marshalls Flying School at Cambridge. With them here is Mr. Frank Morgan, one of the school instructors.

● AMONG the fixtures arranged by the **Royal Aero Club** is a dinner to Jim Denyer and H. A. G. Smith, respectively the 1958 King's Cup winner and British Air Racing Champion. The function will be at 119 Piccadilly on January 27 next.

● OCTOBER'S newsletter from the **Fair Oaks Aero Club** tells us that although the aerodrome surface has dried up there has been poor visibility for flying. Nevertheless five members—Miss Targett, Messrs. Henderson, F. H. White and Swaysland, and A.T.C. Cdt. Gunton—have now got their P.P.L.s; Messrs. Ross and Ramchandran have flown solo.

A quote from the newsletter: "During a recent daily inspection on Chipmunk, G-AORK, the engineers found two ribs bent out of shape in one of the wings. This damage was apparently caused by exceeding the maximum permitted speed in a dive, probably during unauthorized aerobatics. They can be dangerous."

● ONLY 109 hr. were flown by the **Oxford Aeroplane Club** in October, despite concentrated efforts by members and staff. This is 30 hr. fewer than September, and 24 hr. fewer than October, 1957; the club is particularly disappointed, as Tiger Moth, G-ALNA, has been overhauled and restored to the fleet, which otherwise consists of three Tigers, a Chipmunk and an Aiglet. But the weather, of course, has been mostly to blame.

Among the new privately owned aircraft at Kidlington is G-AOCU, the blue-and-white Auster 5 of Stan and Pete Jewson, and Pat Sullivan has now got a Permit to Fly for the Zaunkoenig, G-ALUA.

Film evenings and lectures are being held during the next few months.

● FROM Barton aerodrome the **Lancashire Aero Club** reports that only seven days in October permitted maximum flying, and the monthly total amounted to 58 hr. 5 min. Cdt. Stephens and Mr. Kelsey flew solo, and Cdt. Carter gained his licence.

At the annual general meeting on October 15 the following committee was elected:—

Chairman: D. L. Armitage; members, F. Fairclough, B. Hamblett, A. T. Hodge, R. B. Stockfis, Dr. Sidebotham, J. Simpson, N. Bradpiece, P. Jefferies, L. Roy, R. Ogden and A. C. Lacey.

The Parnell Trophy has been awarded to C. Rollo, assistant flying instructor, for "his meritorious service and devotion to duty during the past year."

● JODEL D.117, G-APOZ, which is the Rollason-built demonstrator at Croydon, has now received A.R.B. validation of its French Certificate of Airworthiness, which includes the VHF 12-channel radio. This two-seat aircraft cruises at 120 m.p.h. and costs £2,500. Anyone interested in inspecting this aircraft and having a demonstration should contact Rollasons' secretary, Mr. W. V. Fitzmaurice, at Croydon 5151.

Gliding Notes

by Dr. A. E. Slater

IN deciding to hold next year's National Gliding Championships at Lasham from Saturday, May 9, to Whit Monday, May 18, we are following the example already set by Holland, and to be adopted also by Germany next year, of having national contests in spring instead of summer.

Experience in western Europe has shown that the best cross-country weather is more likely to be found in May than in July, August and September, when gliding contests in the Northern Hemisphere have usually been held, and there have been years when April was even better than May.

A meteorological proof of these seasonal differences, at least in England, was published in the *Meteorological Magazine* for April this year, where C. J. Boyden wrote about the relation, month by month, between surface temperature and "thickness lines" for the lowest 500 millibars. The "thickness" figure depends on the mean temperature in the lowest 19,000 ft., and so the relation between that and the ground temperature is a measure of the instability in the lower half of the atmosphere and Mr. Boyden shows that instability is greater in April, May and June than in July and August and markedly greater than in the period September to November.

In another table he gives the average temperature lapse (i.e., cooling with increasing height) between the surface and the 700-mb. level, which is at about 10,000 ft. In Southern England the temperature lapse in degrees Fahrenheit varies between the following extremes in each month through spring and summer: April, 21.4-35.7; May, 21.8-38.2; June, 21.8-38.1; July, 21.8-37.6; August, 21.8-37.4; September, 19.4-33.7. Thus the thermals should be at their best in May, and almost as good in June. But remember—these are only average figures, and gliders don't fly in average lapse rates, but in specific ones which vary day by day and hour by hour.

* * *

THE MEMORIAL to the late Frank Foster is now to be a national one, and is likely to take the form of a trophy, though it is not yet decided for what kind of performance the trophy will be given. It may be remembered that Frank Foster repeatedly achieved high placing in the national championships by flying a machine of inferior performance to the best, such as his Rhönbussard, then Meise, and finally Skylark 2.

Contributions to the memorial may be sent either to the London Gliding Club at Dunstable or the British Gliding Association at Londonderry House, 19 Park Lane, London, W.1.

* * *

A SCHLEICHER Ka-8, recently obtained by a club at Offenbach, has in its first two months put in 75 hours' soaring from 41 launches and enabled 12 Silver "C" legs to be flown, says *Flugwelt*.

NAVAL GLIDING.—WRENS at R.N.A.S. Arbroath receive gliding training in the Condor Gliding Club.

Correspondence

Black Knight Deductions

IN "Rocketry at the Needles" (THE AEROPLANE, October 10) a centrally located ball fitting on which the vehicle stands is stated to be "only about 2½ in. in diameter." By checking the photographs the diameter of the vehicle would seem to be about 35 in.

If this is correct, the ball, shown clearly in the close-up of the rocket motors, can only be $1\frac{7}{16}$ in. to 1¼ in. diameter. At first thought this would seem to be very small to retain a vehicle the size of the Black Knight, but if your figure of 20,000-lb. thrust is correct, and remembering that the weight of the vehicle is helping to balance the thrust, the loading in a ball of this size is well within the strength of modern materials. As this method of fixing seems to be rather unusual, perhaps you will be able in time to give more details of how it works?

Beckenham, Kent. G. THOMPSON.

[We congratulate Mr. Thompson on his interesting deductions regarding Black Knight's mounting ball. Our own figure had, perforce, to be quoted as a "round-number" value as precise measurement could not be made; nor was it possible to disclose the exact dimensions of the missile.—ED.]

The Britannia Shield

IS it not time that more attention be given to the spirit of the Britannia Shield and less attention to the actual rules governing the contest? I have in mind the Boxing Section particularly, as although the team representing the "United States Air Forces in Europe" were stationed in Europe before the boxing contest, they had been in Europe less than three weeks, having been flown over from America complete with coaches.

Admittedly, the R.A.F. have a strong force in Europe from which to select their team but one would have imagined that the U.S.A.F. had sufficient personnel in England and Germany to obviate the necessity of bringing over by air at the last moment, eight highly trained fighters to represent them in the Shield.

London, N.4. CYRIL MANN.

Go Home Yanks

THE following comment appeared in *Aviation Week* for November 10, 1958:—

"As we pointed out more than a year ago, the bulk of the early research and development work on missiles of all types was done by the aviation industry with Convair, North American, Martin and Aerojet-General in the Vanguard."

Surely Vickers should chuck them out?

London, W.1. "SMITHSONIAN."

Airborne v. Tail-sitting Launching

YOUR permission would be appreciated to round-off the interesting and possibly significant discussion on Sputnik launching, with the hope that it may catch the eye of those who must be making some pretty hard decisions as regards the Commonwealth's share in space exploration.

Although nobody was able to refute your expert "Kentigern's" contention that the saving in work involved by launching a rocket from an aircraft is but a twentieth of the total, opinions were expressed that increased payload and reliability obtainable by substituting aerodynamic controls for electronics, would be worthwhile. The suggestion was also made that it would be an advantage to fly the rocket to wherever it had to be launched. Of the points made, those seem to lead to a simple conclusion which would render a solution to the difficult technical problems of placing a manned satellite in an orbit and recovering it infinitely more worthwhile.

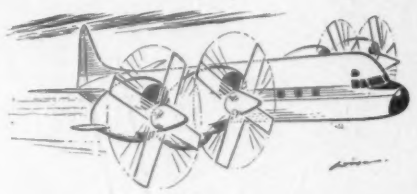
It is agreed that the manned satellite is a practical proposition, and that a vertical launch with a reliable rocket, or more likely formation salvo of rockets, is the more practical method of setting up a space station. What is still lacking, and the inaccuracy of the Moon-shot underlines the difficulties, is any way of sending up to a manned satellite once in orbit the supply train which would be necessary to convert it for penetration into space.

For example, one degree error of final vector leads to a dispersion of the order of 30-50 miles at orbital distance, which could only be eliminated in all probability by taking out the payload in favour of a steerable retro-rocket stage. Inertial guidance seems of double value if the exact orbit of the satellite target is unpredictable.

The obvious alternative is to accept a measure of expendability and to fire off a larger number of smaller unmanned supply rockets than immediately required, although all should be recovered in time. The simplest and most effective "Minimal Satellite" is air-launched, as pointed out by Mr. J. E. Allen in his lecture to the R.Ae.S. (22.1.58), although a boosted Black Knight size of vehicle would be required rather than a staged stand-off bomb development.

London, S.W.3. G. B. BATHURST.

Wroundabout



Electrafication. Flying in Lockheed's Electra the other day, I thought, as I looked at the huge Allison turboprops, of a variation of the old definition of the Beaufighter—"Four mighty engines hotly pursued by an aeroplane." Somebody else suggested that it was the first airliner to have the wings entirely buried in the engines.

*

Nuts. On those engines, Ian Deckman, Allison's asst. sales manager, told me that their engineers had discovered two unusual ways of "cleaning" the engine when a gradual accumulation of oil and other deposits on the compressor blades had reduced power output, as can happen with any turbine. The first was to fly through a snow shower, the second, believe it or not, was to use walnut shells. When I asked Ian where you might find a shower of walnuts, he patiently explained that they were ground up before being shovelled in. I've heard of strawberry pips being squirted at cylinder heads to polish them but *walnut shells* . . . who *thinks* of these things?

*

Chuck and Double Chuck. An amusing story about the Electra's successful tour. During a demonstration flight from Athens, "Chuck" Mercer, flight-deck commentator, was working madly with conversion tables and other devices, changing miles and pounds into kilometres and kilogrammes for the benefit of those listening in the cabin. And in the cabin? They were equally busy, for their own comprehension, trying to convert them back.

*

Joint Effort. Reader Keith McCall, ex-R.A.F. aircrew, notes the caption in a technical journal: "Newark, N.Y., Airport provides a classic example of the finger system" and thinks this column should do something about it.

*

"What do you think of the new Vanguard?"

"I think it's a winner."

"Yes, it's a good-looking car."

"Oh . . . I thought you meant the Vickers Vanguard."

"No, no, the Vicar's got an Austin, the Squire's got a Vanguard."

*

No Business Like P.R.O. Business

"Tell me, have you ever seen an *old* P.R.O.?"

by Wrem

NOTES AND EVENTS

SEAT PRODUCTION.—Tourist-economy class seats for B.O.A.C.'s D.H. Comet 4 fleet are seen on this highly organized production line at a factory of Microcell, Ltd. The company is also making a newly designed seat for tourists which is being fitted in all the Corporation's Britannia 102s.

CANADIAN OPERATOR. — Autair Helicopter Services, Ltd., of Montreal Airport, which began operations in Eastern Canada last July, now operates a fleet of six Bell 47s, both of the G and H types, two Sikorsky S-51s and an S.E.3130 Alouette. The last-named is the first of its type to be used in Canada. Mr. J. P. Fournier and Mr. H. K. Iverson have recently been made directors of the company and Mr. P. H. Holland is now sales manager.

AIRCRAFT EQUIPMENT. — The Aviation Division of the Dunlop Rubber Co., Ltd., Foleshill, Coventry, has published a new edition of its "Aviation Equipment Manual." Its contents include additional information on the company's high-pressure tyre ranges and some of the items of ground equipment used in servicing tyres, wheels and brakes.

ALUMINIUM NEWS. — A third edition of "Welding Aluminium" has been published by the Northern Aluminium Co., Ltd., of Bush House, Aldwych, London, W.C.2. It deals with various types of welding and welding processes, strength of welded joints and other technical data.

LIGHT LIFTER.—Weighing just 1 lb. the Haltrac "Midget Hoist" can lift up to 1,000 lb. It is a simple block and tackle unit using nylon cord, costs 57s. 6d., and is produced by Haltrac, Ltd., Bourne Works, Weimar Street, London, S.W.15.

MODEL MISSILE.—Mr. Sebastian de Ferranti, managing director of Ferranti, Ltd. (extreme right), was recently presented with a scale model of the Bristol / Ferranti Bloodhound by Mr. A. Stobbs, (centre), on behalf of the Apprentices Association of the company's guided-weapons establishment. Looking on, left to right, are Dr. N. Searby, head of the establishment, Mr. W. Clarke and Mr. B. Lees.

Personal Notices

BIRTHS

Bisson.—On Nov. 15, at Ely, to Joan (*née* Garrett), wife of Flg. Off. P. Bisson—a daughter.

Denyer.—On Nov. 12, at R.A.F. Hospital, Nocton Hall, to Joan (*née* Duckworth), wife of Sqn. Ldr. L. S. Denyer—twin sons.

Hobday.—On Nov. 16, at Malmesbury Hospital, Wilts, to Sheila (*née* Port), wife of Flt. Lt. D. E. Hobday, R.A.F. Hullavington—a daughter.

Le Cudennec.—On Nov. 16, at Ely R.A.F. Hospital, to Beryl Margaret (*née* Strefford), wife of Sqn. Ldr. R. B. T. Le Cudennec—a daughter.

Stark.—On Nov. 11, at the R.A.F. Hospital, Akrotiri, Cyprus, to Joan (*née* Fridlington), wife of Sqn. Ldr. R. F. Stark—a son.

Wilkinson.—On Nov. 12, at Singapore, to Anne (*née* Price), wife of Flt. Lt. J. C. M. Wilkinson, A.F.C.—a son.

MARRIAGE

Schofield—Kinnear.—On Nov. 8, at St. Giles' Cathedral, Edinburgh, Wg. Cdr. R. A. Schofield, R.A.F., to Joan Ogilvy, Edinburgh.

GYRO DEVELOPMENT. — S. G. Brown, Ltd., of Watford, has developed a Mk. 2 model of its Mk. 1 Master Reference Gyro which is fitted in the latest Fleet Air Arm aircraft. With a total weight of 20 lb., the Mk. 2 M.R.G. has an approximate gyro random wander rate of 1°/hr., an erection time constant of 2 min., and a vertical reference accuracy of 0.2°. Smaller than the Mk. 1, it is 6½ in. in diameter and 13½ in. long.

MURAL TEXTURIDE FABRICS.—Arlington Plastics Development, Ltd., of Harlow, Essex, has introduced a new range of Mural Texturide vinyl-coated fabrics for wall covering, panelling and other surface applications. Suitable for use in aircraft, the fabrics are available in nine new designs and a large number of colours.

Aviation Calendar

December 1.—Royal Society of Arts Cantor Lecture, "The Development of the Aeroplane," by P. Brooks, B.Sc.(Eng.), A.C.G.I., A.F.R.Ae.S., at John Adam Street, **London**, W.2., at 18.00 hrs.

December 1.—R.Ae.S. Derby Branch lecture, "Thrust Reversal for Jet Aircraft," by R. H. Colley, at the Rolls-Royce Welfare Hall, Nightingale Road, **Derby**, at 18.15 hrs.

December 1.—R.Ae.S. Halton Branch lecture, "The Solar System," by Sqn. Ldr. E. A. Newman, at the Branch H.Q., R.A.F. **Halton**, at 18.45 hrs.

December 1.—R.Ae.S. Henlow Branch lecture, "Long Range Forecasting," by Sir G. Sutton, in Building 62, R.A.F. Technical College, **Henlow**, at 19.30 hrs.

December 2.—R.Ae.S. Luton Branch lecture, "Satellites," by E. M. Dowlen (English Electric Co., Ltd.), in the Napier senior staff canteen, **Luton Airport**, at 18.15 hrs.

December 2.—Institute of Metals, Oxford Section lecture, "Inter-Planetary Travel," by L. R. Shepherd, Ph.D., at the Cadena Café, Cornmarket Street, **Oxford**, at 19.00 hrs.

December 3.—London Society of Air Britain talk, "The Cody Controversy," by C. H. Gibbs-Smith and showing of 1958 R.O.C. Master Test Film, at Caxton Hall, Caxton Street, **London**, S.W.1, at 19.00 hrs.

December 3.—Kronfeld Club talk, "Gliding in Uganda," by Basil Bell, at 74 Eccleston Square, **London**, S.W.1.

December 3.—Radar and Electronics Assn. lecture, "Exploration of the Upper Atmosphere by Rockets and Satellites," by R. F. L. Boyd, Ph.D., at the Royal Society of Arts, John Adam Street, **London**, W.C.2., at 19.00 hrs.

December 4.—R.Ae.S. Main Lecture at Birmingham Branch, "Freighters — A General Survey," by E. D. Keen, F.R.Ae.S., at the College of Technology, **Birmingham**, at 19.00 hrs.

December 4. — R.Ae.S. Christchurch Branch, joint lecture with the Institution of Mechanical Engineers, "Aero Engines Past, Present and Future," by A. D. Baxter, at the King's Arms Hotel, **Christchurch**, at 19.30 hrs.

December 4.—R.Ae.S. London Airport Branch lecture, "Airline Operational Flying," by Capt. W. Baillie, M.V.O., O.B.E., A.F.R.Ae.S. (general flight manager, B.E.A.), in B.E.A.'s Viking Centre Cinema, Hatton Cross, **London Airport**, at 18.00 hrs.

December 4.—R.Ae.S. Bristol Branch lecture, "Britannia: An Operator's Report," by J. E. D. Williams, at Filton House, **Bristol**, at 18.00 hrs.

December 4.—Women's Engineering Society London Branch lecture, "Helicopters," at Hope House, 45 Great Peter Street, Westminster, **London**, S.W.1., at 19.00 hrs.

December 5.—Helic. Assn. of G.B., discussion evening, in the R.Ae.S. Library, 4 Hamilton Place, **London**, W.1., at 18.00 hrs.

December 6.—British Interplanetary Society lecture, "Rocket Nozzles and Exhaust Jets," by E. T. B. Smith, B.Sc., in the Tudor Room, Caxton Hall, Caxton Street, **London**, S.W.1, at 18.00 hrs.

December 8.—Royal Society of Arts Cantor Lecture, "The Future of the Aeroplane," by Eric Mensforth, C.B.E., M.A., M.I.Mech.E., F.R.Ae.S., at John Adam Street, **London**, W.C.2, at 18.00 hrs.

LONDON MOVE.—The London district office of The British Thomson-Houston Co., Ltd. (manager, Mr. J. L. Dixon) has moved from Crown House, Aldwych, to 33 Grosvenor Place, London, S.W.1. The British Thomson-Houston Export Co. (managing director, Mr. E. V. Small) is already established at the new address. (Tel., Belgravia 7011.)

New Patents

APPLICATIONS ACCEPTED

807,169.—Couzinet, R. A. A.—"Multi-winged aircraft."—May 24, 1956 (May 25, 1955, Sept. 15, 1955, and Dec. 30, 1955).

807,183.—Zborowski, H. P. G. A. R. von.—"Self-propelled airborne bodies, and particularly special self-propelled devices."—March 27, 1957 (March 29, 1956).

Applications open to public inspection on Jan. 7, 1959, opposition period expires on April 7, 1959.